TRC

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2006 SEDIMENT SAMPLING WORK PLAN

Shieldalloy Metallurgical Corporation

Newfield, New Jersey

Prepared by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

A Remedial Investigation (RI) was conducted by TRC Environmental Corporation (TRC) at the Shieldalloy Metallurgical Corporation (SMC) facility located in Newfield, New Jersey between October 1990 and April 1991. The RI was conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and as required under a New Jersey Department of Environmental Protection (NJDEP) Administrative Consent Order (ACO dated October 5, 1988). The purpose of the RI was to investigate the physical characteristics of the site, as well as potential sources of contamination, determine the nature and extent of contamination and characterize potential health risk and environmental impact.

Ground water at the facility is currently being addressed as a separate Operable Unit (OU) under a Record of Decision (ROD) that was signed in September 1996. Under the ROD, ground water is being extracted, treated on-site for the removal of chromium and trichloroethylene (TCE) and discharged to the Hudson Branch, which traverses the southem border of the SMC facility.

Supplemental sampling of soil, sediment and surface water was conducted in 1995 and 1996 in support of the preparation of Feasibility Studies (FSs) addressing these media. The results of this sampling were reported in the April 1996 Draft Final Feasibility Study Report. The FS Report included the evaluation of soil and sediment contaminant levels and the determination of those areas requiring further evaluation with respect to potential remedial altematives. Based on the defined areas of concem, the FS Report evaluated soil and sediment remedial altematives and, based on regulatory review of and comment on the FS, a preliminary agreement was reached as to the nature of the soil and sediment remedial actions to be proposed for public comment.

Given the time that has passed since the preparation of the 1996 FS and potential environmental changes at the site, specifically with respect to the potential movement of sediment due to natural processes, supplemental sampling is appropriate prior to the finalization of the portion of the FS document related to surface water and sediment. This plan has been prepared to describe the additional sampling and analyses to further evaluate sediment remediation. The soil operable unit and soil sampling activities to be conducted to further evaluate soil remediation will be addressed within a separate document.

1.1 Site Location

The SMC facility is located at 35 South West Boulevard, primarily in the Borough of Newfield, Gloucester County, New Jersey. A small portion of the southwest comer of the site is located in the City of Vineland, Cumberland County, New Jersey. A site location map is provided in Figure 1-1. The manufacturing portion of the facility and associated support areas coyer approximately 67.7 acres. The approximate center of the facility is located at latitude 39°32'27.6"N, longitude 75°01'06.7"W. SMC also owns an additional 19.8 acres of farmland, located approximately 2,000 feet southwest of the main facility in Vineland. This farmland property has never been used for manufacturing or related activities.

The SMC facility is bounded to the north by a former rail spur and to the west by Conrail rail lines and by West Boulevard. Woods, residences and small businesses are present to the east of the site. The southem property line is bounded by the Hudson Branch, its associated wetlands/headwaters, and an unnamed pond. Residences are located along Weymouth Road, south of the Hudson Branch.

The majority of the site is surrounded by secure steel-wire fencing, except for a small portion of the property along the westem property boundary, where the facility parking lot is located, that lies outside of the fenceline. A detailed plan depicting the boundaries and physical features of the facility is provided as Figure 1-2. An aerial photo of the facility (January 2005) is provided in Figure 1-3.

1.2 Site Use and History

The SMC facility manufactured specialty steel and super alloy additives, primary aluminum master alloys, metal carbides, powdered metals and optical surfacing products. Raw materials used at the facility included ores which contain oxides of columbium (niobium), vanadium, aluminum metal, titanium metal, strontium metal, zirconium metal, and fluoride (titanium and boron) salts. During the manufacturing process, slag, dross and baghouse dust were generated.

One of the materials received, used and stored by SMC contained radioactive material classified as "source material" pursuant to 10 CFR Part 40. This material is called pyrochlore, a concentrated ore containing columbium (niobium) and greater than 0.05% of natural uranium and natural thorium. It is therefore licensable by the USNRC. An area referred to as the Storage Yard area, approximately 7 acres in size and located in the eastem portion of the site, has historically been used to store USNRC-regulated materials generated as a result of former manufacturing processes. A defined portion of this area has been designated a restricted area in the facility's USNRC radioactive materials license (License No. SMB-743). The USNRC-controlled materials at the facility are being addressed within a separate Decommissioning Plan.

1.3 Surface Water Hydrology

The predominant surface water body at the SMC facility is the Hudson Branch. The Hudson Branch is a tributary of Bumt Mill Pond, as indicated in Figure 1-1, and Bumt Mill Branch flows from Bumt Mill Pond to the Maurice River. The Hudson Branch is a tributary to Bumt Mill Branch, and originates just to the east of the SMC facility. The upstream drainage area of the Hudson Branch (upstream of a point adjacent to the Storage Yard) is estimated at 1.85 square miles, most of which is only sparsely developed. Ground water discharge appears to be the primary source of water to the Hudson Branch in times of no or low precipitation. During periods of increased precipitation, the Hudson Branch originates as far as 300 feet east of the facility, and water ponds within the marshy area at the southwest comer of the site.

From its point of origin, the Hudson Branch flows westward through portions of the SMC facility and along the facility's southem property boundary. A small ponded area (referred to herein as the unnamed pond), approximately 1.4 acres in size, is located within this reach of the Hudson Branch, immediately south of SMC's former thermal cooling pond (see Figure 1-2). The channel of the Hudson Branch along the southem boundary of the facility varies in size and ranges from 10 to 20 feet wide and from 1 to 3 feet deep. Downstream of the SMC facility, the Hudson Branch flows through a combination of undeveloped areas, residential areas and some agricultural areas.

The Hudson Branch joins the Bumt Mill Branch approximately 6,500 feet southwest of the site. A 15-acre pond (Bumt Mill Pond) exists at the confluence of the Hudson Branch and

Bumt Mill Branch (also referred to as the Manaway Branch), impounded by an eight-foot-high dam. The watershed area for Bumt Mill Pond is reported to be 4,123 acres. The pond is reported to be shallow, with a mean depth of 2.4 feet. The Bumt Mill Branch continues from Bumt Mill Pond, joining the Maurice River approximately 9,000 feet southwest of Bumt Mill Pond.

Within the SMC facility itself, drainage from developed portions of the facility is managed via a storm drain system and through overland flow. Most of the drainage from the developed portion of the site is directed to the on-site drainage basin (pond) located in the southwestem portion of the facility. The drainage from the far westem employee parking lot area is discharged into a ditch near the westem boundary of the facility. Stormwater drainage in the eastem undeveloped area of the facility is generally via sheet flow.

An area referred to as the thermal pond is located in the south-central portion of the site. Based on historic aerial photos presented in the RI/FS Work Plan, the thermal pond was constmcted sometime between 1965 and 1974. Details on its historic use are not known although, it is understood that it was used for the natural cooling of heated water. Available information and schematics of wastewater treatment operations associated with the historic lagoons at the facility do not indicate that the thermal pond was ever associated with those operations. The aerial photos in the 1989 RI/FS Work Plan indicate that the thermal pond contained water in 1974 and 1977 aerial photos but is nearly dry in the 1986 aerial photo. In the time since the 1989 RI/FS Work Plan was prepared, the thermal pond has not been used for any specific purpose and is typically wet only after stormwater events. Because the thermal pond is not consistently inundated, it is unlikely to support aquatic organisms and therefore is not addressed with respect to potential investigation as part of this sediment sampling plan, but will be considered within the soil sampling plan (to be submitted in the future, upon resolution of TRC's request to NJDEP for an altemate remedial criterion for beryllium).

Historically, the SMC facility had three permitted discharge outfalls to the Hudson Branch. Following the closure of on-site lagoon features and subsequent to the preparation of the FS report, the outfalls were revised to reflect current discharge conditions at the facility. Currently permitted outfalls include outfalls DSN003A and DSN004A.

DSN003A is located in the westem portion of the SMC facility and is used for stormwater discharges from the employee parking lot and other westem portions of the SMC facility. Discharges from this outfall are regulated under stormwater discharge general permit NJ0088315. The drainage ditch that discharges to this outfall is generally dry, conveying water only during stormwater-generating precipitation events. Based on the general lack of industrial activities upgradient of this drainage area, its potential to act as a source of contamination to the Hudson Branch is considered to be small.

DSN004A is located at the southwest comer of the drainage basin in the southwest portion of the SMC facility. DSN004A receives a combination of facility stormwater and treated water from the on-site ground water treatment system. When on-site operations were more extensive, non-contact cooling water was also discharged at this location. Flows from DSN004A are recorded at an H-flume located at the outfall. According to the NJPDES permit application documents for the SMC facility, the monthly average daily flow from outfall DSN004A is approximately 0.53 million gallons per day (368 gallons per minute). Historically, before the closure of the on-site lagoon features (see Figure 1-2) in the late 1990s, only stormwater and non-contact cooling water were discharged at this location, which was previously referred to as DSN002. At that time, the drainage basin as it currently exists was not present. The existing drainage basin and tributary drainage way were constmcted using clean fill only after the lagoon closure activities were complete.

In addition to SMC's two permitted outfalls, a third outfall is located just west of the former thermal cooling pond. This outfall discharges stormwater from a portion of the Borough of Newfield located north of the SMC facility. A 36-inch diameter stormwater pipe enters the SMC facility at the northem property line, crosses the SMC facility and discharges into the Hudson Branch at this location. Historically (including during the period that the FS was prepared), this discharge location was permitted as outfall DSN001 and was the point at which treated ground water and stormwater were discharged, along with non-contact cooling water. Currently only stormwater from the Borough of Newfield is discharged at this location. Based on this change in discharge locations, Hudson Branch flow rates between former outfall DSN001 and current outfall DSN-004A are likely to be significantly less under current conditions that they were before the relocation of the discharge point for treated ground water and stormwater.

2.0 RI AND FS SUMMARY

The 1990-1991 RI field activities included surface soil sampling, surface water and sediment sampling, test pit sampling, soil boring sampling, monitoring well installation and ground water sampling. Supplemental investigations conducted in 1995 and 1996 included surface and subsurface soil sampling, surface water and sediment sampling, soil gas survey, monitoring well installation and ground water sampling.

A brief summary of the sediment and surface water sampling results, specifically focused on the characterization of the Hudson Branch and the potential areas of concem identified in previous investigations and the FS report, is provided below by environmental medium.

Following the presentation of the summary of the RI activities is a summary of the preferred remedial altematives for sediments, based on the FS as well as NJDEP comments on the FS, followed by a brief discussion of the steps that will follow the finalization of the RI/FS activities.

2.1 Sediment RI Summary

A limited sediment sampling program (consisting of five samples) was conducted during the RI, followed by a much more comprehensive sediment sampling program during the 1995/1996 supplemental sampling, which involved 27 sediment sampling stations, as indicated in Figures 2-1 and 2-2. Sample locations included locations within the Hudson Branch as well as reference pond and stream sediment locations. Sediment sampling was accompanied by the collection of eight sediment samples for bioassay analysis (using the amphipod *Hyalella azteca* and the midge *Chironomus tentans*) and macrobenthic invertebrate analysis. A cover type survey and a macrobenthic invertebrate bioassessment study were also conducted. Wetlands along the Hudson Branch were delineated and surveyed.

A detailed analysis of the sediment sampling results was presented in the FS, which reflected the following:

- a comparison of detected contaminant levels to sediment quality guidelines (effects range-low [ER-L] and effects range-median [ER-M] values developed by Long and Morgan and the Ministry of Ontario's lowest effect levels [LELs] and severe effect levels [SELs]);
- sediment toxicity testing results;
- species dominance;

- species diversity;
- species richness/equitability;
- metals intolerant species;
- habitat assessment;
- cover type; and
- a comparison to background/reference location results.

The screening level comparison identified the presence of pesticides, PCBs, and metals (arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc) above the screening levels, as indicated in Tables 2-1 and 2-2. Table 2-1 also indicates the general variability in sediment sample results from one location to another. In the toxicity testing, no significant mortality was observed in any of the *C. tentans* samples, although lower growth was observed in some samples when compared to the laboratory control. This was thought to be attributable to sediment characteristics rather than high metals concentrations. Significant differences in the survival of *H. azteca* were noted in some samples when compared to the laboratory control. Discrepancies were observed, however, when contaminant levels and site observations were compared to *H. azteca* survival (e.g., *H. azteca* was actually present in sediment samples collected at two location that exhibited significant mortality in the laboratory toxicity studies). The macrobenthic invertebrate analysis studies generally indicated no difference between the on-site pond and the reference pond. Stream samples exhibited some impacts when compared to the reference sample. Metals intolerant species were identified at some locations that exhibited elevated metals levels. The habitat value was found to be fairly high at one location (SD-19) but was considerably lower at other pond and stream locations. The results of the cover type survey are presented in Figure 2-3.

2.2 Surface Water RI Summary

Five surface water samples were collected from the Hudson Branch during the RI and were supplemented by surface water samples collected from seven sampling stations during the supplemental investigations in 1995. Surface water sample results were compared to federal Ambient Water Quality Criteria and New Jersey Surface Water Quality Criteria (SWQC) for FW2-classified waters that were applicable at the time the FS was prepared. Trichloroethene, was detected in one RI sample at a level of 3 ppb, which exceeded the SWQC of 1.09 ppb.

Bis(2-ethylhexyl)phthalate was the only semivolatile organic compound detected at a level exceeding the SWQC. It was detected in one sample at 2 ppb, which exceeds the SWQC of 1.76 ppb. No pesticides/PCBs were detected in the surface water samples. Metals, including antimony, arsenic, beryllium, cadmium, chromium, copper, cyanide, iron, lead, mercury, nickel and zinc, were detected in surface water samples at levels exceeding AWQC or SWQC. In the RI Hudson Branch samples, the highest levels of inorganic contamination were detected in surface water sample SW02, located just downstream of historic SMC Outfall 001. The highest levels of inorganics were detected in supplemental samples SW-8, collected near the headwaters of the Hudson Branch, and in SW-25, collected downstream within Bumt Mill Pond. Samples SW-11 and SW-27 also exhibited inorganic analytes at levels exceeding the AWQC or SWQC. In general, the levels of inorganics detected in the surface water during the supplemental sampling event were lower than those detected during the RI and, historically, chromium levels were observed to have continually decreased since the earliest surface water sampling was conducted in 1972.

2.3 Ecological Risk Assessment

An Ecological Risk Assessment (ERA) (TRC, 1996, revised January 1997) that included an evaluation of risks to ecological receptors in the Hudson Branch was prepared concurrent with the FS. The identification of remedial areas within the FS reflected the conclusions of the ERA, as discussed in more detail in the following section.

2.4 Sediment FS Summary

The sediment sampling results and analyses were presented and evaluated in the FS, along with proposed remediation areas. The remedial areas (from upstream to downstream) and the basis for their inclusion, as presented in the FS, are summarized:

Westem Portion of Unnamed Pond

- exceedances of ecological effect threshold levels, with significantly higher chemical levels than the other two pond sediment samples;
- observed mortality to *H. azteca* in the laboratory;
- macrobenthic invertebrate bioassessment criteria which indicated moderate impacts (although the reference pond sample exhibited similar characteristics); and
- the potential for the sediments to migrate downstream.

Unnamed Pond to Upstream of SD-13

- exceedances of ecological effect threshold levels;
- lack of biotoxicity or macrobenthic invertebrate bioassessment data for this portion of the stream to confirm or deny ecological impacts (while such data are not available, the similarity of the physical and chemical features of this portion of the stream to the SD-13 to West Boulevard portion (described below) indicated the potential for such impacts to exist);
- the apparent previous disruption of this portion of the stream, as evidenced by aerial photograph observations (see Section 1.7.1 of Volume I of the Feasibility Study) and the presence of opportunistic species such as phragmites, which could be expected to result in poor wildlife habitat quality within this stretch of the Hudson Branch; and
- the potential for the sediments to migrate downstream.

SD-13 to West Boulevard

- exceedances of ecological effect threshold levels, similar to the portion of the stream from the unnamed pond to upstream of SD-13;
- observed mortality to *H. azteca* in the laboratory;
- macrobenthic invertebrate bioassessment criteria which indicated the community had been impacted;
- the relatively poor macrobenthic and wildlife habitat quality within this stretch of the Hudson Branch; and
- the potential for the sediments to migrate downstream.

Wetland areas with a low habitat value (as characterized by a phragmites understory) adjacent to the portion of the Hudson Branch between SD-13 and West Boulevard were also included in the defined remedial area, partly based on the presence of exceedances of New Jersey soil cleanup criteria guidelines in the wetland soils.

The results of the ERA and FS were also presented at a technical meeting held with NJDEP, EPA and Biological Technical Assessment Group (BTAG) representatives on May 7, 1996. Consensus was reached at the meeting that quantitative limits would not be used to delineate the sediment remedial areas, as subsequently documented in the following NJDEP comment on the FS dated June 27, 1996:

> NJDEP Comment 4, Delineation of Sediment Remedial Action
> One of the major agreements reached at the 7 May 1996 technical meeting was the decision to define the limits of sediment removal based on qualitative parameters related to vegetative cover types and not ecological cleanup criteria. This was a consensus reached among the regulatory officials present as a mechanism to limit the widespread removal of valuable forested wetland communities, while still permitting the removal of high levels of sediment contamination.

The June 27th FS comments also specifically indicated a need to remediate additional portions of the Hudson Branch sediments, beyond those identified in the FS. These areas are described below, along with NJDEP's specific comments as to why they were to be included in the remedial area:

> The remainder of the unnamed pond, per NJDEP comment 3: General Response Actions - Unnamed Pond, Section 2.4.2 p. 2-39:
> The FS Report concludes that the area of the unnamed pond that would require any remediation would be the westem half of the pond. The Ecological Risk Assessment, supported by the chemical, sediment toxicity and benthic community results, suggests that the entire pond (with the possible exception of the extreme eastem fringe) will require remediation.
>
> "Hot spots" in the corridor between West Boulevard and Weymouth Road, per NJDEP comment 5: General Response Actions - West to Weymouth, Section 2.4.5 p. 2-43:
> The FS Report concludes that the area from West Boulevard to Weymouth Road (the vicinity of sediment sample SD-17) does not require remedial action. While the agencies concur that the mature growth palustrine forest should be protected from extensive remediation, it is clear that the contaminant concentration and the sediment sink that exists in this area necessitates some remediation of this "hot spot" along the stream corridor.
>
> Area near SD-19, per NJDEP comment 7: Remedial Altemative Recommendation, Section 4.5, p. 4-56:
> As discussed at the May 7, 1996 meeting, the remediation of the area of sample SD-19 will require remediation along with the rest of the identified sediment areas, and not as a contingency as proposed.

The SD-19 depositional area had been identified in the FS as a contingency remedial area based on the following, :

- exceedances of ecological effect threshold levels, with some of the highest sediment chemistry levels detected in Hudson Branch sediment samples;
- observed mortality to *H. azteca* in the laboratory;
- conflicting macrobenthic invertebrate bioassessment criteria which variously indicated moderate impacts (species dominance), slight impacts (species diversity) and no impact (equitability) to the macrobenthic community;
- the potential for the sediments to migrate downstream; and
- the habitat in SD-19 area, which consists of native herbaceous plants, good cover types, and the interspersion of shallow and deep pools.

Areas of proposed remediation, as presented in the FS and as modified based on the NJDEP comments on the FS listed above, are indicated in Figure 2-4.

NJDEP comments (specifically Comment 4) also included a concem that contamination above human health-based sediment criteria could not remain on off-site properties without a Declaration of Environmental Restrictions (DER). During a February 18, 1997 teleconference involving NJDEP, SMC and TRC, it was stated that, based on NJDEP's in-house risk calculations, NJDEP viewed beryllium levels in sediment that exceed 3 ppm as presenting an unacceptable potential risk to human health. It was also stated that NJDEP's review of the sediment data identified only a few instances where the 3 ppm beryllium level is exceeded at locations outside of those sediment areas which had already been defined as sediment remedial action areas. During the teleconference, the possibility of conducting additional hot spot removals in these areas (e.g., near sediment samples SD-18 and SD-23) in combination with post-excavation sampling was identified as a means of addressing NJDEP's concems. However, in 1998, toxicity information available through the USEPA's Integrated Risk Information System (IRIS) was updated to incorporate more recent research that indicates beryllium is less toxic than previous research had indicated. Therefore, a higher residential cleanup criterion can now be supported for beryllium. TRC is currently requesting an altemate remedial criterion for beryllium from NJDEP; if granted, this altemate criterion will be expected to address any potential human health risk-based concems regarding the presence of beryllium in sediments.

Remedial altematives developed and evaluated in detail in the FS are summarized in Table 2-3. Based on the analysis presented in the FS, a recommendation was presented to implement Altemative SW/SD-4-1. NJDEP did not indicate any objections to this recommendation within their FS comments, provided that the additional remedial areas defined within the comments were incorporated into the remedial action. Therefore, the proposed remedy to address the remedial areas defined in the FS, as modified by NJDEP comments, would be as described below.

Altemative SW/SD-4-1, Ex-Situ Containment with Source Controls, includes sediment removal and on-site containment to address the remedial areas identified in Figure 2-4. Sediments would be excavated, dewatered, placed on-site, and capped with a vegetative cover. Sediment removal would be limited to the areas indicated ih Figure 2-4, with removal depths as summarized below, from upstream to downstream:

- Westem portion of unnamed pond – 1 foot, per Section 2.4.2 of the FS
- Eastem portion of unnamed pond – 6 inches, based on significant reduction in contaminant levels in the 6- to 12-inch interval (i.e., at SD-09 and SD-09A)
- Stream sediment from unnamed pond to upstream of SD-13 – maximum depth of 2 feet, per Section 2.4.3 of the FS (could not be better defined due to lack of samples collected at depths of greater than 6 inches)
- Stream sediment from SD-13 to West Boulevard – maximum depth of 2 feet, per Section 2.4.4 of the FS (could not be better defined due to lack of samples collected at depths of greater than 6 inches)
- Wetland areas adjacent to the portion of the Hudson Branch between SD-13 and West Boulevard with low habitat value
- "Hot spots" in the corridor between West Boulevard and Weymouth Road, per NJDEP comment 5 – assume no more than 1 foot, given the need to protect surrounding mature-growth palustrine forest
- Area near SD-19, per NJDEP comment 7 – As described in Section 2.2.9 of the FS, this area is extremely mucky, which will impede sediment removal. As a result of the physical constraints associated with sediment removal in this area, the depth of sediment removal is assumed to be 3 feet. The extent of sediment removal would be limited by the adjacent mature-growth palustrine forest area immediately downgradient of SD-19 and by the presence of cleaner sediments at the upgradient SD-18 sampling location.

For the purposes of the FS evaluation, it was assumed that the existing thermal pond area, located north of the unnamed pond, would be lined and used for passive dewatering of the excavated sediments, with water generated by dewatering treated within the on-site ground water treatment system. Once dewatered, the sediments would be placed on-site and covered with a soil cover or pavement to prevent future human exposures. Due to the time that has passed since the wetland areas were originally delineated, a new wetland delineation would be required as part of the remedial action. Following remediation, the impacted wetland areas would be revegetated and restored, and post-construction sediment and surface water quality monitoring would be conducted. More details are provided in Section 4.5 of the FS. Also provided in Section 4.5 of the FS is justification for the selection of this altemative over other altematives, based on the consideration of the FS evaluation criteria.

2.5 Future Tasks

Upon completion of the supplemental sediment sampling activities, the results of the sampling will be incorporated into the existing FS for sediment and surface water, with the FS updated as necessary to reflect any changes detected in the sediment quality. A Proposed Plan will then be developed to present the preferred remedy to the public for comment. Upon receipt and consideration of public comments, a Record of Decision will be developed that will document the selected remedy for the site. Following the formal remedy selection, remedial design activities will commence and the selected remedial altemative will be implemented. It is expected that additional wetland delineation and assessment activities will be conducted as part of the remedial design/implementation effort.

3.0 PROPOSED SAMPLING PLAN

Additional data are needed to evaluate whether changes in environmental conditions since the supplemental sampling was conducted in 1995 and 1996 may impact the selection of the sediment remedial action. Specifically, natural transport processes associated with sediment in a stream situation as well as anthropomorphic changes in sediment transport associated with the relocation of SMC's outfall for treated ground water may have impacted sediment quality.

The sections below provide a summary of the data needs, as well as a sampling plan for addressing those data needs.

3.1 Data Needs

As indicated in Figure 2-4, proposed sediment remedial areas extend from the eastem end of the unnamed pond (near SD-9) to West Boulevard, between West Boulevard and Weymouth Road, and include a downgradient depositional area near SD-19. The main purpose of the supplemental sampling will be to determine if existing conditions with respect to sediment quality have drastically changed since the FS was prepared. The sampling plan relies on previous decision-making steps that were conducted during the development of the scope of the original RI and the supplemental 1995 sampling effort to focus the scope of this confirmational sampling effort. For example, based on the general lack of detection of organic constituents (including volatile organics, semi-volatile organics, pesticides and PCBs) in sediment samples during the 1990 sediment sampling effort and the subsequent focusing of the 1995 sediment sampling effort the characterization of inorganics in the sediments, this sampling program also focuses solely on inorganics. Due to the variability that is inherent to sediment sample results, it is expected that the results of the supplemental analyses will not necessarily correlate directly to the previous sample results, even if sediment conditions have not significantly changed. As the remedial areas described in Section 2.3 were defined on a qualitative basis, considering other factors such as surrounding cover type, and not strictly on the basis of quantitative criteria, such variations in contaminant levels will not impact the definition of remedial areas. Only significant differences in contaminant levels will trigger a reconsideration of the extent of sediment remedial areas. No surface water sampling is proposed for the current investigations.

3.2 Proposed Sampling and Analyses

To provide the necessary sediment data to support the completion of the sediment and surface water FS, sediment samples will be collected at ten locations within the Hudson Branch/unnamed pond and one location within Bumt Mill Pond, with additional sediment samples collected at the reference stream location SD-35 and at a reference pond location within Bumt Mill Pond that is comparable to historic sample location SD-30. The exact locations of the pond samples (unnamed pond and Bumt Mill Pond) will be determined in the field to be consistent with the historic sample locations but located where the samples can be collected by hand, without a boat (i.e., from the shoreline with an auger extension). Proposed sediment sample locations are indicated in Figure 3-1, with the exception of the SD-35 sample location, which will coincide with the original location indicated on Figure 2-2. The basis for selection of each sample location and sample depth is presented in Table 3-1. Based on the sample depths provided in Table 3-1, a total of 19 sediment samples will be collected. Chemical analyses as well as toxicity testing will be performed, as described below.

3.2.1 Sediment Sample Locations

Samples will be collected at the sites of previous sediment samples. Where survey data for the previous samples are available, a GPS will be used to relocate the sediment sample locations that are being resampled in this effort. As mentioned above, the exact locations of the pond samples (unnamed pond and Bumt Mill Pond) will be determined in the field to be consistent with the historic sample locations but located where the samples can be collected by hand, without a boat (i.e., from the shoreline with an auger extension). The Bumt Mill Pond sample location will be located within the eastem portion of the pond to be as consistent as possible with either previous sample location SD-25 or SD-26. The reference pond sample location will be located near the northem end of the pond, comparable to the original pond reference sample location SD-30.

3.2.2 General Sampling Methodology

Sediment samples will be collected in a downstream-to-upstream fashion to minimize impacts of water/sediment disturbances on subsequent sampling locations.

At each of the sampling locations, the hydraulic and physical characteristics of the stream will be noted (i.e., stream depth, stream width, approximate flow velocity, stream bed material, and total thickness of organic matter (to underlying native mineral soils (e.g., sand)) and recorded in a field notebook. Additional sample documentation procedures are described in Section 4.3.

3.2.3 Sample Collection and Chemical Analyses

Stream sediment samples will be collected from each location at depths prescribed in Table 3-1 using a pre-installed polyvinyl chloride (PVC) pipe and a hand auger. A decontaminated, four-inch diameter PVC pipe will be driven into the sediment to a predetermined depth based on the proposed depth(s) of sample collection. At a minimum, the pipe will be driven ½-foot deeper than the deepest sample interval. Prior to installation, the predetermined depth will be marked on the outside of the PVC piping so as to provide a visual reference during installation. Note that this depth will be modified as necessary (e.g., increased) to account for standing water. Sediment samples will be collected within the pipe using dedicated stainless steel augers, one for each sample interval, as needed. This technique will allow for the collection of sediment samples with minimal collapse of the borehole, as the PVC pipe will impede the influx of water. For pond sediment samples that are collected from the adjacent shoreline, the samples will be collected using stainless steel augers.

The contents from each auger will be placed into a dedicated stainless steel mixing bowl and homogenized. The sediment sample will also be geologically logged for grain size, color, texture, consistency, and other physical parameters (e.g., staining, odors, etc.). These observations will be recorded in a field notebook. Once homogenized, the sample will be placed in appropriate sample containers as described in Table 3-2 and will be analyzed for:

- Metals that were detected above screening levels during the 1995/1996 sampling events (all EPA Method 6010), namely:
    - o Arsenic;
    - o Cadmium;
    - o Chromium;

  - o Copper;
  - o Iron;
  - o Lead;
  - o Manganese;
  - o Mercury;
  - o Nickel; and
  - o Zinc
- pH
- Total organic carbon (TOC); and
- Grain size analysis.

Temperature, conductivity, pH and dissolved oxygen will be measured in the field at each sample location.

After the sediment sample is placed in the appropriate sample containers, any residual sediment will be returned to the sample location. For stream sediment samples, the residual sediment will be replaced inside the PVC pipe prior to removing the pipe from the stream bed. The stream sample locations will be documented with a real-time GPS and, for future reference, each location will be marked with a wooden stake that will be driven into the stream bank and/or surveyor's flagging that will be placed on vegetation close to the sample location. For pond sediment samples collected from the adjacent shoreline, the shoreline location will be documented using a GPS and the location of the sediment sample approximated from that reference location.

3.2.4 Sample Collection and Toxicity Testing

In addition to chemical analyses of the sediment material, sediment samples will be collected for toxicity testing to indicate the bioavailability of contaminants in the sediment material and to determine whether contaminants within the sediment material are producing adverse effects on species within the Hudson Branch. To evaluate the toxicity of sediments, a bulk sediment bioassay test will be conducted in which sediment samples will be collected and benthic invertebrates (specifically the amphipod *Hyalella azteca* and the midge *Chironomus tentans*) will be exposed to the sediment material in a laboratory environment. Growth and mortality are some of the characteristics used to assess the toxicity of the sediments. Sediment bioassays will be conducted on sediments from the 0- to 6-inch interval at five of the sediment sample locations: SD-9A, SD-17, SD-18, SD-19 and SD-35 (also indicated in Table 3-1). These locations were selected based on the previous performance of sediment bioassays at these locations (SD-9A, SD-17 and SD-19), based on the desire to determine if contaminants have migrated downstream from previously sampled locations and the potential impacts associated with such migration (SD-18), or were selected to represent a reference stream location (SD-35).

Sediment samples will be collected from depositional areas at each of the five selected sample locations using a bucket sampler. These samples will be collected as close as possible to the original sediment sample point. Temperature, conductivity, pH and dissolved oxygen will be measured in the field at each sample location.

Toxicity testing will utilize the amphipod *Hyalella azteca* (in 28-day testing with survival/growth endpoints) and the midge *Chironomus tentans* (in 10-day testing with acute survival/growth endpoints). In previous acute 10-day bioassay testing at the site utilizing both *H. azteca* and *C. tentans*, *C. tentans* did not exhibit significant mortality but did exhibit lowered growth at several locations (SD-9A, SD-10, SD-19 and SD-23); *H. azteca*, however, exhibited differences in survival at several locations (including SD-9A and SD-19) when compared to the laboratory control sediment.

The sediment bioassay work will follow the protocols outlined by Methods of Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates, Second Edition (EPA 2000). Monitored toxicity endpoints will be survival and growth. As with the original bioassay tests, the following water chemistry parameters will be specified for lab culture water to match surface water conditions: pH (6.0-7.0); hardness (20-30 mg/L) and total suspended solids (12-23 ppm). Dissolved oxygen will be specified as greater than 40% saturation in the culture water, as specified in the original bioassay testing. Each of the collected samples will be tested in replicate, with eight replicates per sample tested for survival and growth at the end of each test period.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The following is a summary of the various QA/QC protocols that will be followed throughout the sediment sampling program to ensure the collection of representative samples and to ensure proper handling.

4.1 Field Quality Control Samples

Field quality control (QC) samples will include equipment blanks, field duplicates, MS/MSDs, and temperature blanks. Because no samples will be analyzed for volatile organics, trip blank samples will not be collected. The number of samples described below is based on the assumption that all sediment samples can be collected in a single day. If additional days are required, the sample frequency will be adjusted accordingly.

4.1.1 Equipment Blank

An equipment blank will be collected in order to determine the cleanliness of sample collection equipment. The equipment blank is used to check for procedural contamination at the site which may impact sample contamination and to ensure that the decontamination procedure has been properly performed. The equipment blank will consist of analyte-free water (laboratory-supplied, HPLC-grade, ASTM Type II) that has been poured over decontaminated sampling equipment and into the appropriate sample containers. One equipment blank will be collected at the beginning of the day's sampling event and will accompany the samples collected throughout that day. The equipment blank will be submitted for analysis for the same chemical parameters as the sediment samples.

4.1.2 Field Duplicate

A field duplicate is an additional aliquot of the same sample submitted for the same parameters as the original sample. A field duplicate will be used to assess the sampling and analytical reproducibility. The procedure for collecting a field duplicate sample consists of alternating the collection of the sample between the sample collection bottle and the duplicate sample bottle. Field duplicates are submitted at a frequency of one per twenty investigative samples; therefore a single field duplicate will be collected and submitted for analysis of all associated chemical parameters. The field duplicate sample will be identified and labeled as a blind duplicate. as described in Section 4.3.3.

4.1.3 Matrix Spike/Matrix Spike Duplicates (MS/MSDs)

MSs and/or MSDs are an additional aliquot of the same sample submitted for the same parameters as the original sample. However, the additional aliquot is spiked with the compounds of concem. Matrix spikes provide information about the effect of the sample matrix on digestion and/or measurement methodology. Based on the number of sediment samples to be collected, a single MS sample and a single MSD sample will be submitted.

4.1.4 Temperature Blanks

Cooler temperature blanks consist of a laboratory-supplied sample container filled with non-preserved water (potable or distilled) and are included in all coolers. The laboratory uses these temperature blanks to ensure that proper preservation of the samples has been maintained during sample shipment. The temperature of these blanks must be 4 °C ±2° to demonstrate that proper preservation has been maintained. The laboratory records the results of the temperature blanks on the chain-of-custody immediately upon receipt of the samples at the laboratory, prior to inventory and refrigeration.

4.2 Sample Sequence

Sediment samples will be collected in a downstream to upstream fashion to minimize impacts of water/sediment disturbances on subsequent sampling locations.

4.3 Sample Documentation Requirements

Documentation used to record field sampling activities and manage samples is discussed in the following sections.

4.3.1 Field Notes and Photodocumentation

A field logbook will be used to document all field activities. Field logbooks provide the means of recording the chronology of data collection activities performed during the investigation. As such, entries will be described in as much detail as possible so that a particular situation could be reconstructed without reliance on memory. The logbook will consist of a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is initialed and dated by the sampler. The correction shall be written adjacent to the error.

Field activities will be fully documented. At a minimum, the hydraulic and physical characteristics of the stream will be noted (i.e., stream depth, stream width, approximate flow velocity, stream bed material, and total thickness of organic matter (to underlying native mineral soils (e.g., sand)) at each sample location. Logbooks will be supported by standardized forms, where appropriate. A photo will also be taken at each sample location.

4.3.2 Chain-of-Custody Records

Sample custody is discussed in detail in Section 4.5 of this document. Chain-of-custody records are initiated by the samplers in the field. A chain-of-custody record will accompany the sample from initial sample container selection and preparation at the laboratory to the field for sample containment and preservation and through its return to the laboratory. If samples are split and sent to different laboratories, a copy of the chain-of-custody record will be sent with each sample. TRC will retain one copy of the chain-of-custody upon relinquishing the sample. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or composite; (4) signatures of individuals involved in sampling; and (5) if applicable, air bill or other shipping number. Sample receipt and log-in procedures at the laboratory are described in Section 4.5.2 of this document.

Samples will be transferred to the custody of the respective laboratories, via direct delivery, third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures and field chain-of-custody procedures are described in Sections 4.4 and 4.5.1 of this document.

4.3.3 Sample Labeling

Each sample collected will be assigned a unique identifier. The sample identification will include information that reflects the sample was collected as part of the 2006 supplemental sediment sampling activities, a sample number, the sample matrix, and reference to the depth interval from which the sample was collected. The samples will be labeled as follows:

Example: SD-9A-0706-A,

where:

"SD": indicates a sediment sample;
"9A" indicates the sample location;
"0706" indicates the month/year sample was collected (e.g., 0706 for July 2006); and
"A": indicates the depth interval (i.e., A - 0 to 6 inches, B - 6 to 12 inches, C - 12 to 24 inches)

Field duplicate samples will be labeled as blind duplicates by giving them sample numbers that are indistinguishable from a normal sample. Cooler temperature blanks will be spelled out and included on one line of the chain-of-custody. Equipment blanks will be spelled out. MS/MSDs will be noted in the "Remarks" column of the chain-of-custody.

4.4 Sample Handling and Shipping

Appropriate sample containers will be used so that no chemical alteration occurs between the collection of samples in the field and the receipt of samples at the laboratory. The sample bottles will be prepared and shipped to the field by TRC's subcontracted analytical laboratories. The sample bottles will be transported to the site within a sealed shipping cooler. These bottles will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest U.S. EPA's *Specifications and Guidance for Contaminant-Free Sample Containers* (December 1992). Certificates of analysis are provided with each bottle lot and maintained on file in the laboratory to document conformance to EPA specifications.

Sample containers will be selected to ensure compatibility with the potential contaminants and to minimize breakage during transportation. Sample bottles, holding times and preservation requirements are listed in Table 3-2.

Sample labels will be filled out at the time of sampling and will be affixed to each container to identify the project name and/or sample location, sample number, sampler's initials, date and time of collection, number of containers per parameter (e.g., 1 of 2, etc.), and analyses requested for the sample. Preservatives are also typically noted on the sample label but the use of preservatives is not anticipated during this sampling effort. The sample numbering scheme is presented in Section 4.3.3 of this document. Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.

After the bottles for a given sample location have been filled, they will be immediately placed in a shipping cooler. Samples will be stored in such a way as to protect them from temperature extremes, light, breakage and water damage. Each glass sample container will be placed in an individual bubble wrap bag before being placed in the cooler. Field personnel will add bags of crushed ice or ice packs to the shipping coolers as the samples are collected. When the cooler is filled, additional absorbent, non-combustible packing material (e.g., vermiculite) will be placed in the cooler so that the contents are secure.

Samples will be shipped to the laboratories within 24 hours of collection or sooner, if the analytical method requires it. Samples will be stored in coolers at a temperature of 4°C.

4.5 Sample Custody

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample or evidence file is considered to be under a person's custody if:

- the item is in the actual possession of a person;
- the item is in the view of the person after being in actual possession of the person;
- the item was in the actual physical possession of the person but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

4.5.1 Field Custody Procedures

Samples will be collected following the sampling procedures documented in Section 3.0 of this document. Documentation of sample collection is described in Section 4.3 of this document. Sample chain-of-custody and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.

- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented in Section 4.3.3 of this document.

- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in wet weather.

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location.

- All shipments will be accompanied by the chain-of-custody record identifying the contents. A minimum of two copies of the chain-of-custody record will accompany the shipment to the laboratory, and copies will be retained by the sampler and placed in the project files. The laboratory will maintain one file copy, and the completed original will be returned to the TRC Project Manager. A copy of the completed original will be returned as part of the final analytical report.

- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations.

- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

4.5.2 Laboratory Custody Procedures

TRC will notify the laboratory of upcoming field sampling activities and subsequent sample transfer to the laboratory. This notification will include information conceming the number and type of samples to be shipped, as well as the anticipated sample arrival date. Samples will be received and logged in by a designated sample custodian or his/her designee. The sample custodian is responsible for maintaining sample custody and for maintaining all associated custodial documentation records. Upon sample receipt, the sample custodian will:

- Examine the shipping containers to verify that the custody tape is intact,
- Examine all sample containers for damage (i.e., breakages or leaks),
- Detemine if the temperature required for the requested testing program has been maintained during shipment using the cooler temperature blanks and document the temperature on the chain-of-custody records,
- Compare samples received against those listed on the chain-of-custody,
- Verify that sample holding times have not been exceeded,
- Examine all shipping records for accuracy and completeness,
- Determine sample pH (if applicable) of aqueous samples and record on chain-of-custody forms,
- Sign and date the chain-of-custody immediately (if shipment is accepted), note the time that the samples were received and attach the air bill (if applicable),
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the TRC Project Manager,
- Attach laboratory sample container labels with unique laboratory identification and test, and
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and intemal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.

- The Laboratory Project Manager will be notified of sample arrival.

The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

4.6 Field Equipment Decontamination Procedures

Sampling equipment which may be used during the field activities, such as stainless steel spoons or spatulas, stainless steel mixing bowls, and stainless steel bucket augers, will be decontaminated using the following procedures:

1. Wash and scrub with low phosphate detergent in tap water;
2. Rinse with tap water;
3. Rinse with distilled and deionized (ASTM Type II) water;[1]
4. Rinse with 10% ultra pure nitric acid;[2]
5. Rinse with distilled and deionized (ASTM Type II) water rinse;[1,2]
6. Rinse with acetone – pesticide grade solvents or better;[3]
7. Air dry – on clean polyethylene sheeting;[4]
8. Rinse with distilled and deionized (HPLC-grade, ASTM Type II) water rinse;[3]
9. Wrap in aluminum foil shiny side out for transport (if not being used immediately).

NOTES:

1 Intermediate sample rinses may be performed with tap rather than ASTM Type II water.
2 Only if sample is to be analyzed for metals.
3 Only if the sample is to be analyzed for organics. The final rinse must be performed with analyte free HPLC-grade ASTM Type II water. Rinsate volume must be at least five times the volume of the solvent rinse in step 6.
4 Clean equipment may rest on but never be wrapped in clean polyethylene sheeting.

Sampling equipment will be decontaminated prior to use at each sampling location. Phthalate-free gloves must be worn during the decontamination procedure. Decontamination rinsates will be collected and containerized for subsequent determination of proper handling and/or disposal.

5.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

Investigation-derived waste (IDW) materials produced during the sampling effort may include solid or liquid residue generated as a result of sampling or decontamination. The amount of IDW material that is generated will be minimized to the greatest extent possible.

Waste decontamination materials, such as spent nitric acid used for decontamination of sampling equipment, will be segregated according to compatibility class, containerized, labeled, and managed for proper treatment or disposal. The pH of dilute solutions of containerized spent acid and water (tap and/or deionized water) will be field checked for pH prior to disposal. If the spent solution registers a pH less than 2.0 units or greater than 12.5 units, the solution will be managed as a corrosive waste.

Expendable supplies and equipment (e.g., tyvek coveralls, gloves, boot covers, tubing, filters, etc.) will be placed into trash bags and disposed of a solid waste unless unanticipated circumstances result in the materials being grossly contaminated.

6.0 DATA EVALUATION AND PRESENTATION

The results of the sediment sampling and analysis effort will be presented in a brief report that describes the field sampling tasks and all field sampling observations. Results from the chemical analyses and toxicity testing will be presented and evaluated, and as applicable, compared to Applicable or Relevant and Appropriate Requirements (ARARs) for the site. Results will be compared to previous study results to determine if there is evidence of significant migration of contaminated sediments since the 1995/1996 sampling events. Recommendadons will be made with respect to the impacts of the results on the previously proposed Hudson Branch sediment remedy.

A draft report will be submitted for regulatory comment. Upon receipt of regulatory comments, the report will be revised, as necessary, and finalized. Data generated during the investigations will also be submitted electronically in NJDEP's HAZSITE format.

Concurrent with the finalization of the sampling report, the existing FS will be revised to reflect the results of the recent sampling. As necessary, the scope of the remedial altematives and associated costs will be revised to reflect current conditions. Based on the revisions to the FS, a Proposed Plan and Record of Decision will be developed, as previously described in Section 2.5.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD01	SD02	SD03	SD3	SD04	SD05		(1)		(2)
"DUPE" if Duplicate				DUPE					MOE	
SAMPLE DEPTH (ft):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Oct. 1990	Oct. 1990	Oct. 1990	Oct. 1990	Oct. 1990	Oct. 1990				
VOLATILE ORGANICS (ppb)										
ACETONE	330 BJ*	430 BJ*	360 BJ*	190 BJ*	290 BJ*	220 BJ*				
CARBON DISULFIDE	-	-	-	-	-	4 J				
1,2-DICHLORETHENE (total)	-	-	2 J	-	5 J	-				
2-BUTANONE	72	130 J	120	51	55	69				
TRICHLOROETHENE	-	-	-	-	-	7 J				
TOTAL VOCs	402	560	482	241	350	300				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	100 J	N/A	N/A	N/A	520 J	N/A				
BENZOIC ACID	1000 J	N/A	N/A	N/A	3200 J	N/A				
PENTACHLOROPHENOL	330 J	N/A	N/A	N/A	-	N/A				
PHENANTHRENE	-	N/A	N/A	N/A	110 J	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	490 JB	N/A	N/A	N/A	580 JB	N/A				Table
FLUORANTHENE	120 J	N/A	N/A	N/A	210 J	N/A	600	5100	750	2-2
PYRENE	-	N/A	N/A	N/A	130 J	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	140 J	N/A	N/A	N/A	-	N/A				
CHRYSENE	-	N/A	N/A	N/A	140 J	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	580 J	N/A	N/A	N/A	270 J	N/A				
BENZO(b)FLUORANTHENE	-	N/A	N/A	N/A	110 J	N/A				
TOTAL caPAH	ND	N/A	N/A	N/A	250	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	18 J	N/A	N/A	N/A	11 J	N/A	2.2	27	5	See
4,4-DDD	5.3 J	N/A	N/A	N/A	18 J	N/A			8	Table
4,4-DDT	33 J	N/A	N/A	N/A	28 J	N/A	1.58	46.1	7	2-2
AROCLOR-1248	-	N/A	N/A	N/A	-	N/A	22.7	180	30	
AROCLOR-1254	160 J	N/A	N/A	N/A	95 J	N/A	22.7	180	60	
AROCLOR-1260	-	N/A	N/A	N/A	-	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	13500	26700	5070	4520	6780	9750				
ANTIMONY	-	270	36.3	29.7	28.7	35.8	2	25		
ARSENIC	5.1	16.1	12.3	11.2	8.4	9.8	8.2	70	6	33
BARIUM	129	408	146	139	194	307				
BERYLLIUM	9.1	22.8	5.9	5.2	3.8	5.6				
CADMIUM	-	-	-	-	-	-	1.2	9.6	0.6	10
CALCIUM	2960	3790	1210	1060	1500	3470				
CHROMIUM	1220	15700	1950	1780	1770	2350	81	370	26	110
CHROMIUM VI	-	-	-	-	-	-	<81	<310		
COBALT	6.0 B	45.3	16.5	14.8	14.2	21.3				
COPPER	25.3	327	93.0	71.1	149	65.8	34	270	16	110
IRON	13600	17800	8500	7450	8300	10400			20,000	40,000
LEAD	364	338	104	77.4	51.8	69.8	46.7	218	31	250
MAGNESIUM	868 B	1300	507	438	447	745				
MANGANESE	238	227	227	205	336	655			460	1,100
MERCURY	-	2.2	0.16	0.61	0.88	1.1	0.15	0.71	0.2	2
NICKEL	64.1	423	257	205	135	96.5	20.9	51.6	16	75
POTASSIUM	597 B	-	471	357	-	-				
SELENIUM	4.4	-	-	-	1.1	1.9				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	199 B	860	553	556	257	554				
VANADIUM	1890	4850	1160	997	647	800				
ZINC	231	529	164	139	115	175	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.

(2) - Ontario Ministry of the Environment (MOE), Lowest Effect Level (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: # ER-M and/or SEL value exceeded: # N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-6A	SD-6B	SD-6C	SD-7-01	SD-8-01	SD-9-01		(1)		(2)
"DUPE" if Duplicate									MOE	
SAMPLE DEPTH (ft):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (total)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	12	N/A	N/A	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	-	N/A	N/A	N/A	N/A			8	Table
4,4-DDT	N/A	14	N/A	N/A	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	-	N/A	N/A	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	-	N/A	N/A	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	-	N/A	N/A	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	13500	5090	12400	5170	5350	9340				
ANTIMONY	-	-	-	-	31.8	29.6	2	25		
ARSENIC	1.9	1.4	2.1	0.46	1	4.6	8.2	70	6	33
BARIUM	122	43	123	83.7	190	163				
BERYLLIUM	1.8	0.81	1.6	1	1.4	1.8				
CADMIUM	0.55	0.59	0.48	0.6	-	-	1.2	9.6	0.6	10
CALCIUM	2910	1350	2530	1180	2540	2630				
CHROMIUM	61.5	30.1	66.2	150	628	1400	81	370	26	110
CHROMIUM VI	-	-	-	-	-	-	<81	<310		
COBALT	5	2.2	3.9	2.5	4.8	5.6				
COPPER	10.5	4.5	8.7	6.1	46.2	34.3	34	270	16	110
IRON	16800	7210	12400	4310	4470	7280			20,000	40,000
LEAD	97.8	59.6	97.2	109	46.9	97.7	46.7	218	31	250
MAGNESIUM	1620	635	1760	1050	917	935				
MANGANESE	297	137	320	210	109	248			460	1,100
MERCURY	0.09	0.06	0.09	-	0.16	0.14	0.15	0.71	0.2	2
NICKEL	25.2	11.7	29.5	24	80.9	57.1	20.9	51.6	16	75
POTASSIUM	322	219	330	333	234	663				
SELENIUM	0.27	-	0.38	0.83	0.93	2				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	99.9	80.7	93.3	136	846	1290				
VANADIUM	284	134	261	137	150	781				
ZINC	59.2	23.8	58.3	47.6	125	101	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: #　　ER-M and/or SEL value exceeded: #　　N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFIGATION:	SD-9-02	SD-9A-01	SD-9A	SD-9A-02	SD-10-01	SD-33-01		(1)		(2)
"DUPE" if Duplicate						DUPE			MOE	
SAMPLE DEPTH (ft):	0.5 - 1.0	0 - 0.5	0 - 0.5	0.5 - 1.0	0 - 0.8	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Aug. 1995	Sept. 1995	Aug. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (total)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	N/A	N/A	N/A	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	N/A	N/A	N/A	N/A			8	Table
4,4-DDT	N/A	N/A	N/A	N/A	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	1200	10500	20800	1350	21500	21900				
ANTIMONY	-	78.4	60.5	-	96	44.6	2	25		
ARSENIC	0.32	7.3	14.5	0.31	8.2	11.2	8.2	70	6	33
BARIUM	22.4	323	449	10.1	390	399				
BERYLLIUM	0.32	2.4	8.6	0.16	4	22				
CADMIUM	-	-	-	-	3.1	2	1.2	9.6	0.6	10
CALCIUM	352	3720	3870	278	2790	2570				
CHROMIUM	227	4600	5130	48.4	5360	5610	81	370	26	110
CHROMIUM VI	-	-	N/A	-	-	2.4	<81	<310		
COBALT	-	14.4	21.7	-	36	34.2				
COPPER	4.3	101	85.8	2.1	230	231	84	270	16	110
IRON	895	15900	27600	400	40500	40000			20,000	40,000
LEAD	7.9	117	222	3.7	336	537	46.7	218	31	250
MAGNESIUM	147	1590	1890	114	1960	2110				
MANGANESE	22.5	362	498	20.6	731	882			460	1,100
MERCURY	-	-	0.54	-	0.81	1.1	0.15	0.71	0.2	2
NICKEL	9.7	131	168	-	559	566	20.9	51.6	16	75
POTASSIUM	-	896	1960	-	922	973				
SELENIUM	0.32	1.8	1.9	0.24	1.3	1.5				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	378	2610	2970	335	1240	1140				
VANADIUM	91.1	1050	1620	11.4	3530	3380				
ZINC	14.9	241	310	5.1	513	512	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: [#] ER-M and/or SEL value exceeded: [#] N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS TO SEDIMENT QUALITY CRITERIA AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-10	SD-10-02	SD-11-01	SD-11-02	SD-12-01	SD-13-01	(1)		(2)	
"DUPE" if Duplicate				DUPE					MOE	
SAMPLE DEPTH (ft):	0 - 0.5	0.5 - 1.0	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Sept. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (lotal)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	N/A	-	-	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	-	-	N/A	N/A			8	Table
4,4-DDT	N/A	N/A	-	I	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	-	-	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	-	510	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	NR	NR	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	29900	9050	15800	20400	24100	26700				
ANTIMONY	122	44.7	48.8	56.6	170	77.8	2	25		
ARSENIC	24.8	6.2	16.3	25.6	23.8	14.6	8.2	70	6	33
BARIUM	462	213	165	239	288	506				
BERYLLIUM	14.6	1.2	8.2	10.8	3.5	13.2				
CADMIUM	2.3	-	2.4	3.9	-	-	1.2	9.6	0.6	10
CALCIUM	3170	3310	1830	2540	2380	2830				
CHROMIUM	7620	2200	4040	5270	9740	8050	81	370	26	110
CHROMIUM VI	N/A	-	-	-	-	-	<81	<310		
COBALT	36.4	8.7	16.4	23.9	19.5	25.4				
COPPER	241	43.5	361	611	361	244	34	270	16	110
IRON	40800	14300	19500	27600	30500	33500			20,000	40,000
LEAD	381	108	148	212	280	208	46.7	218	31	250
MAGNESIUM	2440	1120	1510	2070	1590	1770				
MANGANESE	696	985	387	661	401	286			460	1,100
MEHGURY	1.4	0.15	1.2	1.3	1.9	1.6	0.15	0.71	0.2	2
NICKEL	472	73	256	346	199	142	20.9	51.6	16	75
POTASSIUM	1930	636	465	776	-	1150				
SELENIUM	1	-	3.4	7.2	5.3	1.4				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	1990	1510	1830	2230	3370	2250				
VANADIUM	3030	713	1330	1670	2720	2010				
ZINC	574	146	468	615	374	316	150	410	120	2,000
THALLIUM	1.1	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by HOAA, 1994.
.evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: #   ER-M and/or SEL value exceeded: #   N/A - Not Analyzed For

See Table 2-2 for Key to B and J qualifiers noted in data summary. NR - Not Reported

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-14-01	SD-14	SD-13-01	SD-16-01	SD-17-01	SD-17		(1)		(2)
"DUPE" it Duplicate									MOE	
SAMPLE DEPTH (ft):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.3	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Sept. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Sept. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (total)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB S (ppb)										
4,4-DDE	N/A	N/A	-	N/A	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	-	N/A	N/A	N/A			8	Table
4,4-DDT	N/A	N/A	-	N/A	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	1300	N/A	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	NR	N/A	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	590	N/A	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	22700	23400	6800	17000	8360	18700				
ANTIMONY	86.5	91.6	-	70.8	54.3	147	2	25		
ARSENIC	18.7	30.7	16.1	11.6	12.6	49.3	8.2	70	6	33
BARIUM	334	405	228	425	262	349				
BERYLLIUM	6	9.4	21.1	11.7	4.6	7.5				
CADMIUM	-	3.6	-	-	-	2.4	1.2	9.6	0.6	10
CALCIUM	3400	3300	918	5070	2460	3320				
CHROMIUM	8190	6700	2100	6730	5760	8500	31	570	26	110
CHROMIUM VI	-	N/A	-	-	-	N/A	<81	<310		
COBALT	21.2	28.3	30.6	21.2	27.2	39.5				
COPPER	185	249	276	335	123	163	34	270	16	110
IRON	22700	29100	14500	12900	18300	32400			20,000	40,000
LEAD	144	264	140	149	133	320	46.7	218	31	250
MAGNESIUM	1740	1650	1250	1820	1540	2220				
MANGANESE	265	296	141	1200	977	1030			460	1,100
MERCURY	1.2	1.2	0.89	0.46	0.45	0.56	0.15	0.71	0.2	2
NICKEL	124	222	1090	552	428	655	20.9	51.5	16	75
POTASSIUM	705	1110	-	522	630	1730				
SELENIUM	1.6	3.8	1.3	-	-	1.3				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	2350	2410	794	778	1110	2910				
VANADIUM	710	1740	3680	1740	658	1330				
ZINC	216	350	374	484	315	427	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: # ER-M and/or SEL value exceeded: # N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary. NR - Not Reported

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-15-01	SD-19-01	SD-19	SD-20-01	SD-21-01	SD-21-02		(1)		(2)
"DURE" if Duplicate									MDE	
SAMPLE DEPTH (ft):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.25	0.26 - 0.75	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Aug. 1995	Sept. 1995	Aug. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (total)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	N/A	N/A	N/A	46	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	N/A	N/A	74	N/A			8	Table
4,4-DDT	N/A	N/A	N/A	N/A	51	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	N/A	N/A	-	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	N/A	N/A	-	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	N/A	N/A	-	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	15500	18300	32700	5340	24000	1420				
ANTIMONY	41.1	25	107	6.6	56.3	-	2	25		
ARSENIC	7.5	24.6	77.6	2.3	22.1	0.48	8.2	70	6	33
BARIUM	121	444	688	129	473	17.1				
BERYLLIUM	5.4	16.3	22.6	1.3	6.4	0.25				
CADMIUM	-	-	2.9	-	-	-	1.2	9.6	0.6	10
CALCIUM	1270	3190	5110	1450	3760	169				
CHROMIUM	3620	4060	7630	736	5820	133	81	370	26	110
CHROMIUM VI	-	6.9	-	-	-	-	<81	<310		
COBALT	18.9	47.3	67.3	5.2	27.6	0.8				
COPPER	112	181	323	15.7	196	5.8	34	270	15	110
IRON	17200	27000	43500	3770	27300	1110			20,000	40,000
LEAD	143	147	266	21.3	174	4.2	46.7	218	31	250
MAGNESIUM	896	1230	2220	509	1500	91.2				
MANGANESE	125	1160	1210	273	928	28.8			460	1,100
MERCURY	6.3	1.4	4.4	0.21	1.3	-	0.15	0.71	0.2	2
NICKEL	210	572	959	22	122	6.3	20.9	51.6	16	75
POTASSIUM	813	366	1650	278	465	-				
SELENIUM	-	2.3	3.4	0.29	0.61	-				
SILVER	-	-	3.9	-	-	-	1	3.7		
SODIUM	1280	1900	2450	767	1090	122				
VANADIUM	753	2690	4870	122	791	38.7				
ZINC	117	427	767	32.6	249	9.9	150	410	120	2,000
THALLIUM	-	-	0.84	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: # ER-M and/or SEL value exceeded: # N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-22-01	SD-23-01	SD-23	SD-24-01	SD-24-02	SD-25-01		(1)		(2)
"DUPE" if Duplicate									MDE	
SAMPLE DEPTH (ft):	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0.5 - 1.2	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Aug. 1995	Sept. 1995	Aug. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (total)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	N/A	N/A	-	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	N/A	-	N/A	N/A			8	Table
4,4-DDT	N/A	N/A	N/A	-	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	N/A	-	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	N/A	-	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	N/A	-	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	3730	10800	11900	667	1110	729				
ANTIMONY	41	33.7	72	-	-	8.2	2	25		
ARSENIC	7.6	11.8	22.4	1.1	0.48	1.7	8.2	70	6	33
BARIUM	146	273	284	47.8	44.2	68.8				
BERYLLIUM	2.2	4.9	3.1	0.34	0.23	0.76				
CADMIUM	-	1.6	1.6	-	-	-	1.2	9.6	0.6	10
CALCIUM	2060	3410	3140	990	1140	1360				
CHROMIUM	1360	3500	2880	53.4	12.2	340	81	370	26	110
CHROMIUM VI	-	-	-	-	-	-	<81	<310		
COBALT	7.6	13.9	20.9	1.5	1.8	2.7				
COPPER	41.3	75.9	73	2.4	1.8	4.8	34	270	16	110
IRON	5670	13600	14600	952	835	961			20,000	40,000
LEAD	44.2	68.2	84.7	5.4	4.7	5.3	46.7	218	31	250
MAGNESIUM	375	948	1020	181	393	289				
MANGANESE	436	370	455	147	106	92.5			460	1,100
MERCURY	0.24	0.43	0.32	-	0.1	0.2	0.15	0.71	0.2	2
NICKEL	57	108	95.6	3.3	2	10.3	20.9	51.6	16	75
POTASSIUM	-	214	579	113	198	281				
SELENIUM	-	-	1.8	0.44	0.77	0.62				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	681	1420	1510	265	543	296				
VANADIUM	283	658	479	36.7	7.1	91.9				
ZINC	90.1	131	187	8.3	2.7	10.9	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: # ER-M and/or SEL value exceeded: # N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMRLE IDENTIFICATION:	SD-25-02	SD-26-01	SD-26-02	SD-27-01	SD-27-02	SD-28-01		(1)		(2)
"DUPE" if Duplicate									MOE	
SAMPLE DEPTH (ft):	0.5 - 1.2	0 - 0.5	0.5 - 1.2	0 - 0.5	0.5 - 1.2	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (total)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	N/A	N/A	N/A	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	N/A	N/A	N/A	N/A			8	Table
4,4-DDT	N/A	N/A	N/A	N/A	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	2300	276	852	430	436	622				
ANTIMONY	-	-	-	-	-	-	2	25		
ARSENIC	2.3	0.36	2.3	0.39	0.33	1.6	8.2	70	6	33
BARIUM	178	32.9	78.2	14.2	14.9	23				
BERYLLIUM	1.9	0.21	0.46	0.18	0.27	0.39				
CADMIUM	-	-	-	-	-	-	1.2	9.6	0.6	10
CALCIUM	4130	607	1960	171	160	468				
CHROMIUM	242	110	210	72.4	41.4	122	81	370	26	110
CHROMIUM VI	-	-	-	-	-	-	<81	<310		
COBALT	2.6	1.6	2.7	3.7	2.5	2.3				
COPPER	4.4	1.8	3.6	1.8	1.8	2.4	34	270	16	110
IRON	3390	448	1810	486	354	2040			20,000	40,000
LEAD	3.4	4.4	20.2	5.8	5.5	17	46.7	218	31	250
MAGNESIUM	913	138	441	43.7	43.7	97.9				
MANGANESE	215	56.9	129	16.6	72.2	34.9			460	1,100
MERCURY	0.2	-	-	-	-	0.08	0.15	0.71	0.2	2
NICKEL	9	2.7	6.7	1.9	3.5	3.2	20.9	51.6	16	75
POTASSIUM	529	70.1	171	175	94.9	177				
SELENIUM	1.6	-	0.91	-	-	-				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	661	140	295	89.1	60.7	86.4				
VANADIUM	114	32.2	68.6	15.2	9.8	62.9				
ZINC	11.1	5.9	9.7	7.6	9.1	11.6	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
.evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: #   ER-M and/or SEL value exceeded: #   N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS TO SEDIMENT QUALITY CRITERIA AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-29-01	SD-29-02	SD-30-01	SD-30	SD-30-02	SD-31-01		(1)		(2)
"DUPE" If Duplicate									MOE	
SAMPLE DEPTH (ft):	0 - 0.5	0.5 - 1.2	0 - 0.5	0 - 0.5	0.5 - 1.2	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Aug. 1995	Aug. 1995	Aug. 1995	Sept. 1995	Aug. 1995	Aug. 1995				
VOLATILE ORGANICS (ppb)										
ACETONE	N/A	N/A	N/A	N/A	N/A	N/A				
CARBON DISULFIDE	N/A	N/A	N/A	N/A	N/A	N/A				
1,2-DICHLORETHENE (lotal)	N/A	N/A	N/A	N/A	N/A	N/A				
2-BUTANONE	N/A	N/A	N/A	N/A	N/A	N/A				
TRICHLOROETHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL VOCs	N/A	N/A	N/A	N/A	N/A	N/A				
BASE NEUTRAL / ACIDS (ppb)										
PHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
BENZOIC ACID	N/A	N/A	N/A	N/A	N/A	N/A				
PENTACHLOROPHENOL	N/A	N/A	N/A	N/A	N/A	N/A				
PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A	N/A	N/A	N/A	N/A	N/A				Table
FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A	600	5100	750	2-2
PYRENE	N/A	N/A	N/A	N/A	N/A	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
CHRYSENE	N/A	N/A	N/A	N/A	N/A	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A				
BENZO(b)FLUORANTHENE	N/A	N/A	N/A	N/A	N/A	N/A				
TOTAL caPAH	N/A	N/A	N/A	N/A	N/A	N/A				
PESTICIDES/PCB'S (ppb)										
4,4-DDE	N/A	N/A	N/A	N/A	N/A	N/A	2.2	27	5	See
4,4-DDD	N/A	N/A	N/A	N/A	N/A	N/A			8	Table
4,4-DDT	N/A	N/A	N/A	N/A	N/A	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	30	
AROCLOR-1254	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	60	
AROCLOR-1260	N/A	N/A	N/A	N/A	N/A	N/A	22.7	180	5	
** INORGANICS (ppm) **										
ALUMINUM	3860	2540	4320	4220	2710	1070				
ANTIMONY	-	-	-	-	-	-	2	25		
ARSENIC	1.2	0.6	2	2.7	1.8	-	8.2	70	6	33
BERYLLIUM	39	52.3	236	198	296	25.3				
BERYLLIUM	0.18	0.24	1.6	1.6	1.1	0.18				
CADMIUM	-	0.62	2.1	-	1.8	-	1.2	9.6	0.6	10
CALCIUM	245	596	3090	2420	4560	331				
CHROMIUM	4.4	3.5	6.8	5.9	4.9	1.6	81	370	26	110
CHROMIUM VI	-	-	-	-	11.4	-	<81	<310		
COBALT	3.8	6	31.7	28.1	12.5	8.9				
COPPER	2	3.8	9.6	6.2	8.1	1.3	34	270	16	110
IRON	3310	2710	4210	4770	3970	590			20,000	40,000
LEAD	11.6	21.4	55.5	35.8	-	4	46.7	218	51	250
MAGNESIUM	241	240	705	539	1030	93.6				
MANGANESE	41.3	90.3	271	328	279	91.4			460	1,100
MERGURY	-	0.1	1.3	1.2	0.3	0.07	0.15	0.71	0.2	2
NICKEL	2.4	3.1	16.2	12.8	4.8	2.6	20.9	51.6	16	75
POTASSIUM	201	240	385	-	500	-				
SELENIUM	0.27	-	-	0.99	-	-				
SILVER	-	-	-	-	-	-	1	3.7		
SODIUM	56.8	100	192	186	251	70.5				
VANADIUM	7.2	5.5	10.9	7.8	12.7	1.4				
ZINC	8.7	36.3	68.7	39.9	23.2	10.6	150	410	120	2,000
THALLIUM	-	-	-	-	-	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
.evel (LEL) and Severe Effecl Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Quality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: #   ER-M and/or SEL value exceeded: #   N/A - Not Analyzed For

See Table 2-2 for key lo B and J qualifiers noted in data summary.

TABLE 2-1
COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS
TO SEDIMENT QUALITY CRITERIA
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
SHIELDALLOY METALLURGICAL CORPORATION

SAMPLE IDENTIFICATION:	SD-35		(1)		(2)
"DUPE" if Duplicate				MOE	
SAMPLE DEPTH (ft):	0 - 0.5	ER-L	ER-M	LEL	SEL
SAMPLING ROUND:	Sept. 1995				
VOLATILE ORGANICS (ppb)					
ACETONE	N/A				
CARBON DISULFIDE	N/A				
1,2-DICHLORETHENE (total)	N/A				
2-BUTANONE	N/A				
TRICHLOROETHENE	N/A				
TOTAL VOCs	N/A				
BASE NEUTRAL / ACIDS (ppb)					
PHENOL	N/A				
BENZOIC ACID	N/A				
PENTACHLOROPHENOL	N/A				
PHENANTHRENE	N/A	240	1500	560	See
DI-n-BUTYLPHALATE	N/A				Table
FLUORANTHENE	N/A	600	5100	750	2-2
PYRENE	N/A	665	2600	490	
BUTYLBENZYLPHTHALATE	N/A				
CHRYSENE	N/A	384	2800	340	
bis(2-ETHYLHEXYL)PHTHALATE	N/A				
BENZO(b)FLUORANTHENE	N/A				
TOTAL caPAH	N/A				
PESTICIDES/PCB'S (ppb)					
4,4-DDE	N/A	2.2	27	5	See
4,4-DDD	N/A			8	Table
4,4-DDT	N/A	1.58	46.1	7	2-2
AROCLOR-1248	N/A	22.7	180	30	
AROCLOR-1254	N/A	22.7	180	60	
AROCLOR-1260	N/A	22.7	180	5	
INORGANICS (ppm)					
ALUMINUM	3900				
ANTIMONY	-	2	25		
ARSENIC	1.5	8.2	70	6	33
BARIUM	82.7				
BERYLLIUM	-				
CADMIUM	-	1.2	9.6	0.6	10
CALCIUM	908				
CHROMIUM	7.5	81	370	26	110
CHROMIUM VI	-	<81	<310		
COBALT	5.8				
COPPER	6.6	34	270	16	110
IRON	2470			20,000	40,000
LEAD	25.8	46.7	218	31	250
MAGNESIUM	324				
MANGANESE	35.4			460	1,100
MERCURY	0.92	0.15	0.71	0.2	2
NICKEL	-	20.9	51.6	16	75
POTASSIUM	-				
SELENIUM	1.6				
SILVER	-	1	3.7		
SODIUM	128				
VANADIUM	7				
ZINC	11.3	150	410	120	2,000
THALLIUM	-				

(1) - Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values originally reported by Long & Morgan (1990), as presented by NOAA, 1994.
evel (LEL) and Severe Effect Level (SEL) values, as presented in Guidelines for the Protection and
: Sediment Ouality in Ontario, June 1992, Revised March 1993.

ER-L and/or LEL value exceeded: # · ER-M and/or SEL value exceeded: # N/A - Not Analyzed For

See Table 2-2 for key to B and J qualifiers noted in data summary.

TABLE 2-2

COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS TO CALCULATED NEW JERSEY SEDIMENT QUALITY CRITERIA AND MOE SEVERE EFFECT LEVELS

Table 1 Constituents	SD01			SD04		
	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)
Phenanthrene	ND	95	35.9	0.11	95	90.1
Fluoranthene	0.12	102	-	0.21	102	-
Pyrene	ND	85	-	0.13	85	-
Chrysene	ND	46	-	0.14	46	-
Total PAH	0.12	1,000	-	0.25	1,000	-
4,4-DDE	0.018	1.9	-	0.011	1.9	-
4,4-DDD	0.0053	0.60	-	ND	0.60	-
4,4-DDT	0.033	7.1	0.214	0.028	7.1	0.536
PCB (Total)	0.16	53	5.03	0.095	53	12.6
Aroclor 1248	ND	(15)	-	ND	(15)	-
Aroclor 1254	0.16	(3.4)	-	0.095	(3.4)	-
Aroclor 1260	ND	(2.4)	-	ND	(2.4)	-

Table 1 Constituents	SD-6B			SD-11-01		
	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)
Phenanthrene	NA	12	-	NA	60	-
Fluoranthene	NA	12.3	-	NA	64.8	-
Pyrene	NA	10	-	NA	54	-
Chrysene	NA	5.6	-	NA	29	-
Total PAH	NA	120	-	NA	640	-
4,4-DDE	0.012	0.23	-	ND	1.2	-
4,4-DDD	ND	0.073	-	ND	0.38	-
4,4-DDT	0.014	0.86	0.0100	ND	4.5	0.0526
PCB (Total)	ND	6.4	0.236	ND	34	1.24
Aroclor 1248	ND	(1.8)	-	ND	(9.5)	-
Aroclor 1254	ND	(0.41)	-	ND	(2.2)	-
Aroclor 1260	ND	(0.29)	-	NR	(1.5)	-

NA = Not analyzed 1 = Interference M = Mean Confidence Limit
ND = Not detected NR = Not Reported - = Not Applicabie

TABLE 2-2

COMPARISON OF CONSTITUENTS DETECTED IN STREAM SEDIMENTS TO CALCULATED NEW JERSEY SEDIMENT QUALITY CRITERIA AND MOE SEVERE EFFECT LEVELS

Table 1 Constituents	SD-11-02			SD-15-01		
	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)
Phenanthrene	NA	79	-	NA	73	-
Fluoranthene	NA	84.6	-	NA	78.3	-
Pyrene	NA	70	-	NA	65	-
Chrysene	NA	38	-	NA	35	-
Total PAH	NA	830	-	NA	770	-
4,4-DDE	ND	1.6	-	ND	1.5	-
4,4-DDD	ND	0.50	-	ND	0.46	-
4,4-DDT	I	5.9	0.0686	ND	5.5	0.0636
PCB (Total)	0.510	44	1.62	1.9	41	1.50
Aroclor 1248	ND	(12)	-	1.3	(12)	-
Aroclor 1254	0.51	(2.8)	-	NR	(2.6)	-
Aroclor 1260	NR	(2.0)	-	.059	(1.8)	-

Table 1 Constituents	SD-21-01			SD-24-01		
	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)	Detected Level (ppm)	Calculated SEL (ppm)	NJDEP Sediment Quality Criteria M (ppm)
Phenanthrene	NA	95	-	NA	12	-
Fluoranthene	NA	102	-	NA	12.9	-
Pyrene	NA	85	-	NA	11	-
Chrysene	NA	46	-	NA	5.8	-
Total PAH	NA	1,000	-	NA	130	-
4,4-DDE	0.046	1.9	-	ND	0.24	-
4,4-DDD	0.074	0.60	-	ND	0.076	-
4,4-DDT	0.051	1.2	0.187	ND	0.90	0.0104
PCB (Total)	ND	53	4.41	ND	6.7	0.246
Aroclor 1248	ND	(15)	-	ND	(1.9)	-
Aroclor 1254	ND	(3.4)	-	ND	(0.43)	-
Aroclor 1260	ND	(2.4)	-	ND	(0.30)	-

NA = Not analyzed I = Interference M = Mean Confidence Limit
ND = Not detected NR = Not Reported - = Not Applicable

TABLE 2-3
SURFACE WATER AND SEDIMENT REMEDIAL ALTERNATIVES
AS PRESENTED IN 1996 FEASIBIILTY STUDY REPORT
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Alternative SW/SD-1
- Natural Attenuation

Alternative SW/SD-2
- Source Controls
  - Best Management Practices
  - Natural Attenuation

Alternative SW/SD-3
- In Situ Remediation (SD-13 to West Boulevard) with Source Controls
  - In-Place Capping
  - Best Management Practices
  - Natural Attenuation

Alternative SW/SD-4
- Ex Situ Containment (Pond Area to West Boulevard, SD-17, SD-19) with Source Controls
  - Excavation and Containment
  - Best Management Practices
  - Natural Attenuation
    - SW/SD-4-1 - On-Site Consolidation
    - SW/SD-4-2 - Landfilling

Alternative SW/SD-5
- Soil Washing (Pond Area to West Boulevard, SD-17, SD-19) with Source Controls
  - Excavation and Soil Washing
  - Best Management Practices

Alternative SW/SD-6
- Outfall Relocation, Ex Situ Containment (SD-17, SD-19) with Source Controls
  - Excavation and Containment
  - Best Management Practices
  - Natural Attenuation
    - SW/SD-6-1 - On-Site Consolidation
    - SW/SD-6-2 - Landfilling

TABLE 3-1

PROPOSED SEDIMENT SAMPLE LOCATIONS AND ANALYSES

Sample Location	Basis for Selection[1]	Sample Depth	Sample Analyses[2]
SD-6	Hudson Branch headwaters; background location	0-6"	Metals, TOC, pH
SD-9A	Eastern end of unnamed pond; verify previously detected contaminant levels (lower than in western portion of pond) and the significant reduction in contaminant levels over the 6 to 12-inch interval; define depth of contamination (exact location to be determined in the field)	0-6", 6-12"	Metals, TOC, pH, bioassay
SD-12	Hudson Branch downstream of former Outfall 001 but upstream of current Outfall 004A; repeat of 1990 SD-02 sample location, thereby providing three data sets over 16-year period; location of highest chromium level detected in Hudson Branch sediments; define sediment quality at depths greater than 6 inches (not previously defined)	0-6", 6-12", 12-24"	Metals, TOC, pH
SD-15	Hudson Branch near point where stream passes beneath West Boulevard, downstream of current Outfall 004A; define sediment quality at depths greater than 6 inches (not previously defined)	0-6", 6-12", 12-24"	Metals, TOC, pH
SD-17	Hudson Branch between West Boulevard and Weymouth Road, in area where hand excavation requested by NJDEP; define depth of contamination; this location is also downstream of current Outfall 003A, the outfall for stormwater drainage from SMC's parking lot area	0-6", 6-12"	Metals, TOC, pH, bioassay
SD-18	Hudson Branch, downstream of Weymouth Road	0-6"	Metals, TOC, pH, bioassay
SD-19	Hudson Branch, downstream of SD-18 in extremely mucky area	0-6"	Metals, TOC, pH, bioassay
SD-04	Hudson Branch within SMC's farm property; downstream of SD-19; only 1990 data at this location	0-6"	Metals, TOC, pH
SD-20	Hudson Branch, downstream of SD-04 and SD-19	0-6"	Metals, TOC, pH
SD-23	Hudson Branch, downstream of SD-19 and upstream of Burnt Mill Pond	0-6"	Metals, TOC, pH
SD-25 or 26	Burnt Mill Pond (exact location to be determined in the field)	0-6"	Metals, TOC, pH
SD-30	Reference pond sediment sample location (exact location to be determined in the field)	0-6"	Metals, TOC, pH
SD-35	Reference stream sediment sample location	0-6"	Metals, TOC, pH, bioassay

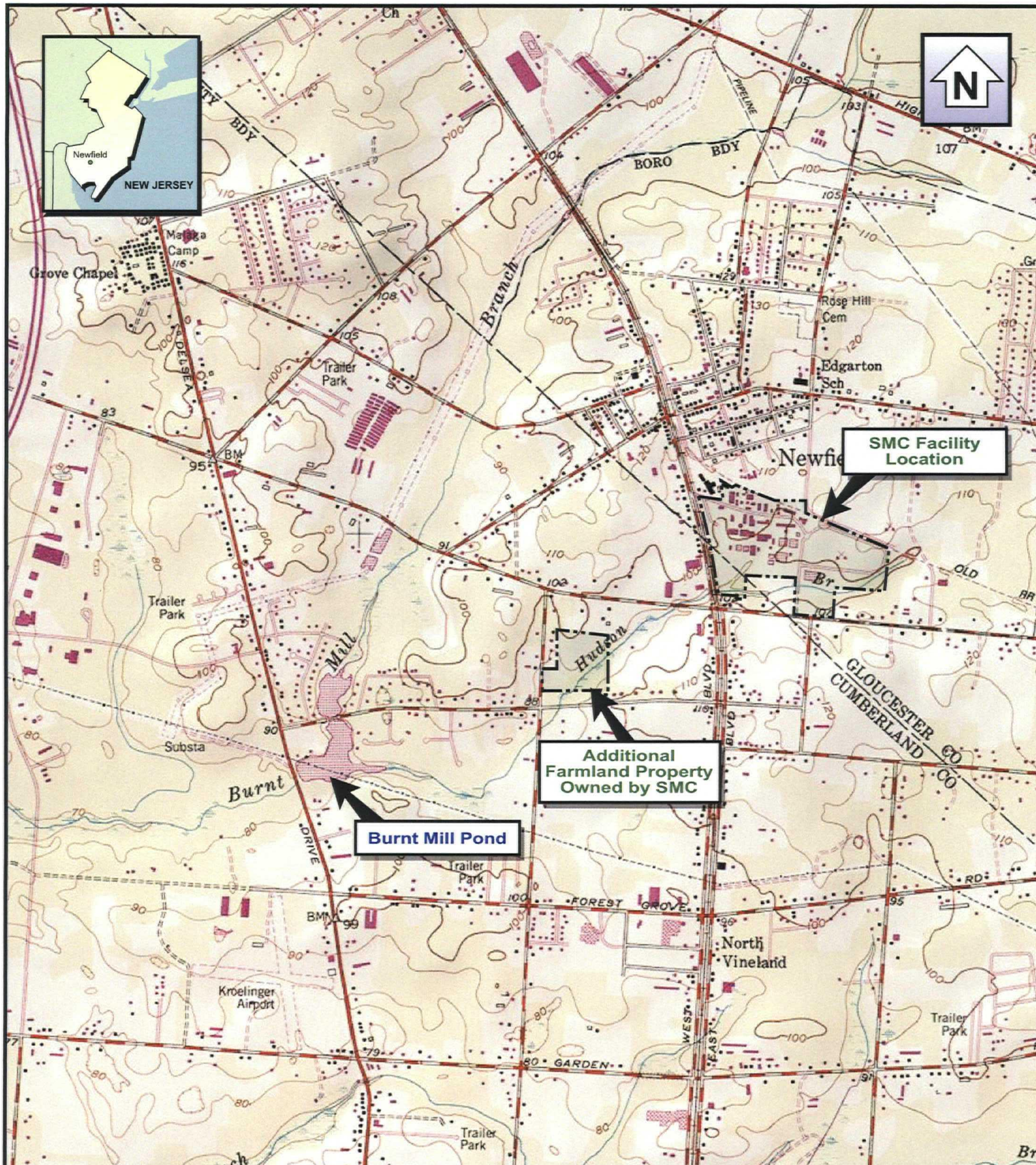
[1] All Hudson Branch sediment sample locations were selected to provide a comparison between contaminant levels detected during earlier sampling events and current conditions. Where other reasons exist to justify sampling at a given location or at different depths, these are noted in the table.
[2] Metals analyses include arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc. Bioassay analyses are based on the use of the amphipod *Hyalella azteca*. All bioassay sample locations are located where previous bioassay samples were collected, with the exception of SD-18, which has been added to provide additional information on potential downgradient migration of contaminated sediments, and SD-35, which represents a reference location.

TABLE 3-2
SEDIMENT SAMPLE CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

Parameter	Container	Preservation	Holding Time[1]
Metals[2]	1 8-oz. wide-mouth amber glass jar with Teflon-lined cap	Cool, 4ºC	Mercury – Analyze within 28 days. Other metals – Analyze within 180 days.
pH[2]	1 8-oz. wide-mouth amber glass jar with Teflon-lined cap	Cool, 4ºC	Analyze within 3 days
Grain size	Ziploc bags	None	None
Total Organic Carbon	1 4-oz glass jar, no headspace	Cool, 4ºC	14 days
Sediment Toxicity	Plastic or Polytetrafluoroethylene	Cool, 4ºC; dark	14 days[3]

Notes:

[1] Holding time begins from date collected.
[3] Metals, and pH can be collected in the same container for sediment samples.
[3] Might be longer, depending on magnitude and type of contaminants present.



0 2000
SCALE FEET

0 1
SCALE 1:24000 MILE

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7.5' USGS TOPOGRAPHIC MAP

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FIGURE 1-1
SITE LOCATION MAP

Date: 05/06 **Project No.** 51903-SEDI-02015

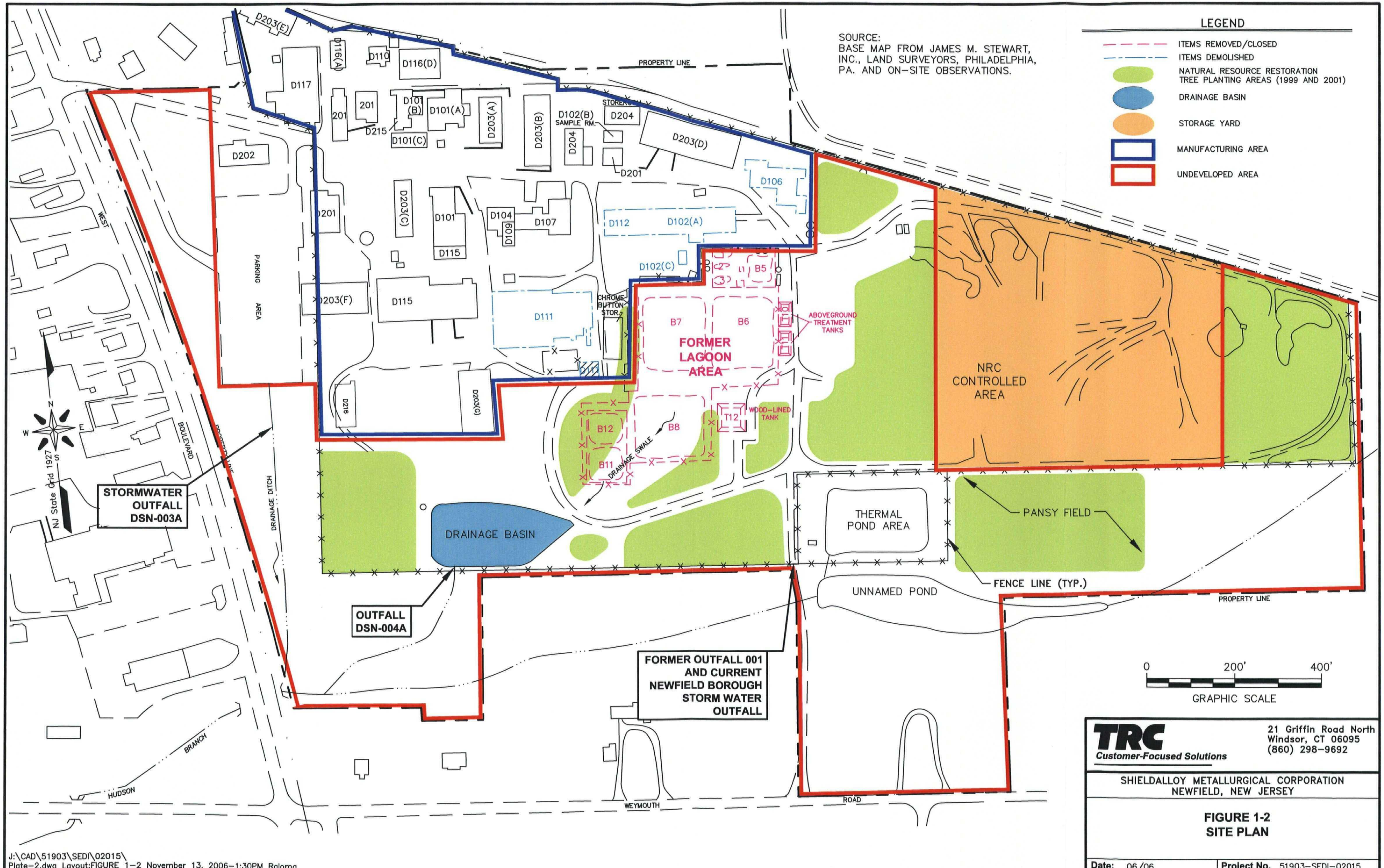

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FIGURE 1-2
SITE PLAN

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Plate-2.dwg Layout:FIGURE 1-2 November 13, 2006-1:30PM Raloma

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FIGURE 1-3
AERIAL PHOTOGRAPH (2005)

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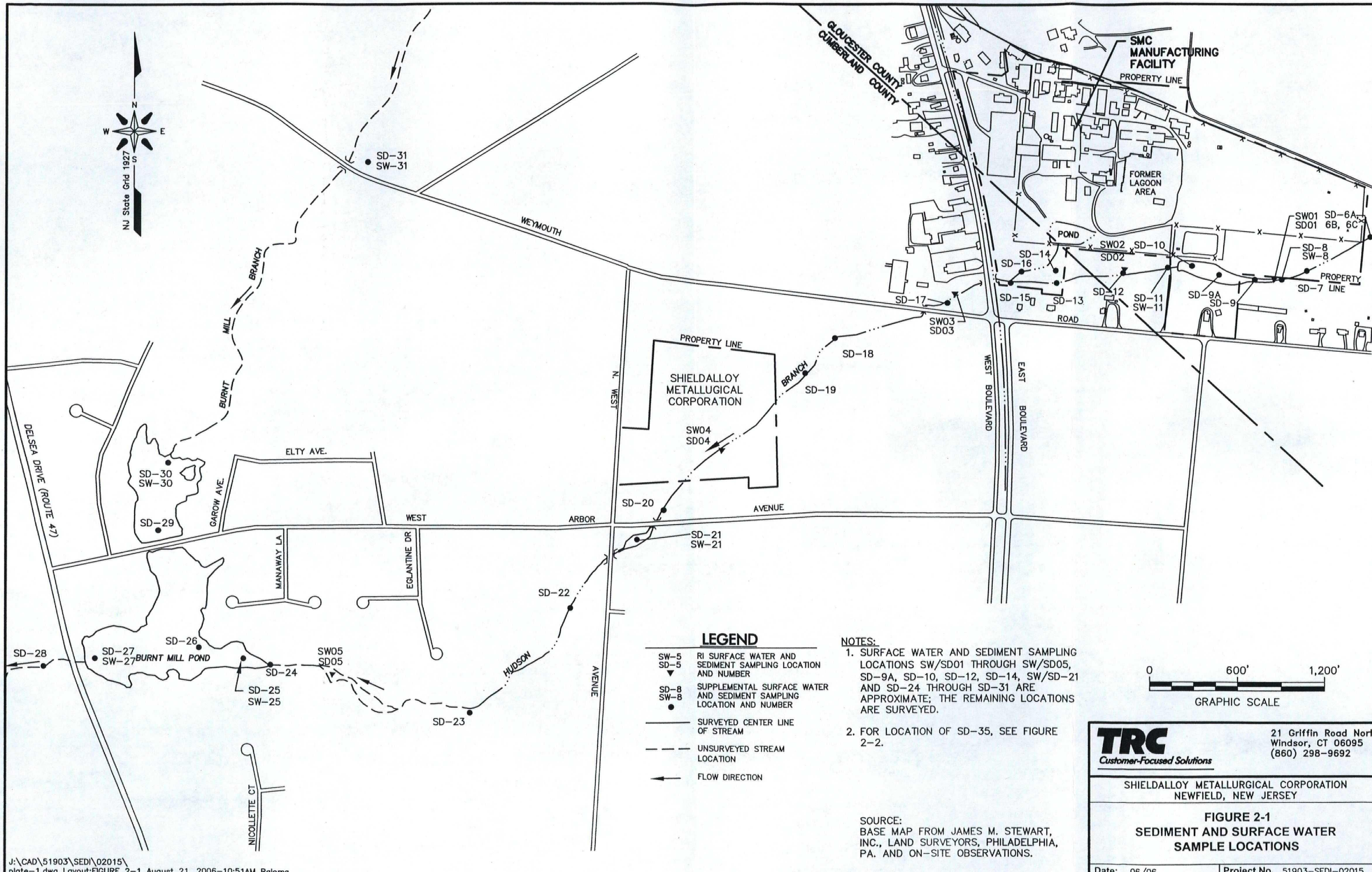
Plate-2.dwg Layout:FIGURE 1-3 November 13, 2006-1:46PM Raloma



LEGEND

- SW-5 / SD-5 ▼ — RI SURFACE WATER AND SEDIMENT SAMPLING LOCATION AND NUMBER
- SD-8 / SW-8 ● — SUPPLEMENTAL SURFACE WATER AND SEDIMENT SAMPLING LOCATION AND NUMBER
- SURVEYED CENTER LINE OF STREAM
- UNSURVEYED STREAM LOCATION
- FLOW DIRECTION

NOTES:

1. SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS SW/SD01 THROUGH SW/SD05, SD-9A, SD-10, SD-12, SD-14, SW/SD-21 AND SD-24 THROUGH SD-31 ARE APPROXIMATE; THE REMAINING LOCATIONS ARE SURVEYED.
2. FOR LOCATION OF SD-35, SEE FIGURE 2-2.

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

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FIGURE 2-1
SEDIMENT AND SURFACE WATER SAMPLE LOCATIONS

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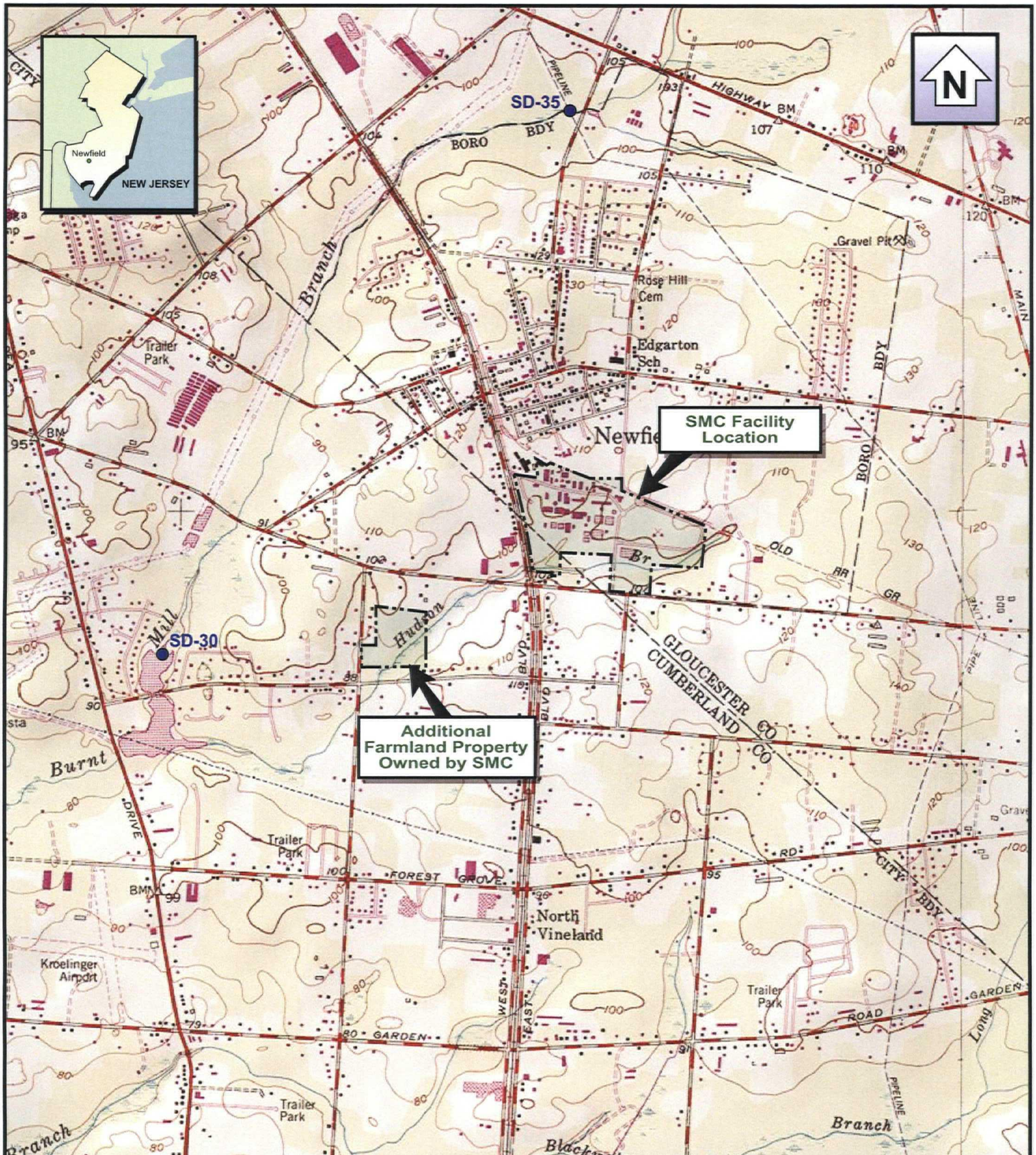
J:\CAD\51903\SEDI\02015\
plate-1.dwg Layout:FIGURE 2-1 August 21, 2006-10:51AM Raloma



KEY

0 — 2000
SCALE — FEET
1:24000

SD-30 ● Reference Sediment Sampling Location and Number

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FIGURE 2-2
REFERENCE STREAM & POND SEDIMENT SAMPLE LOCATIONS

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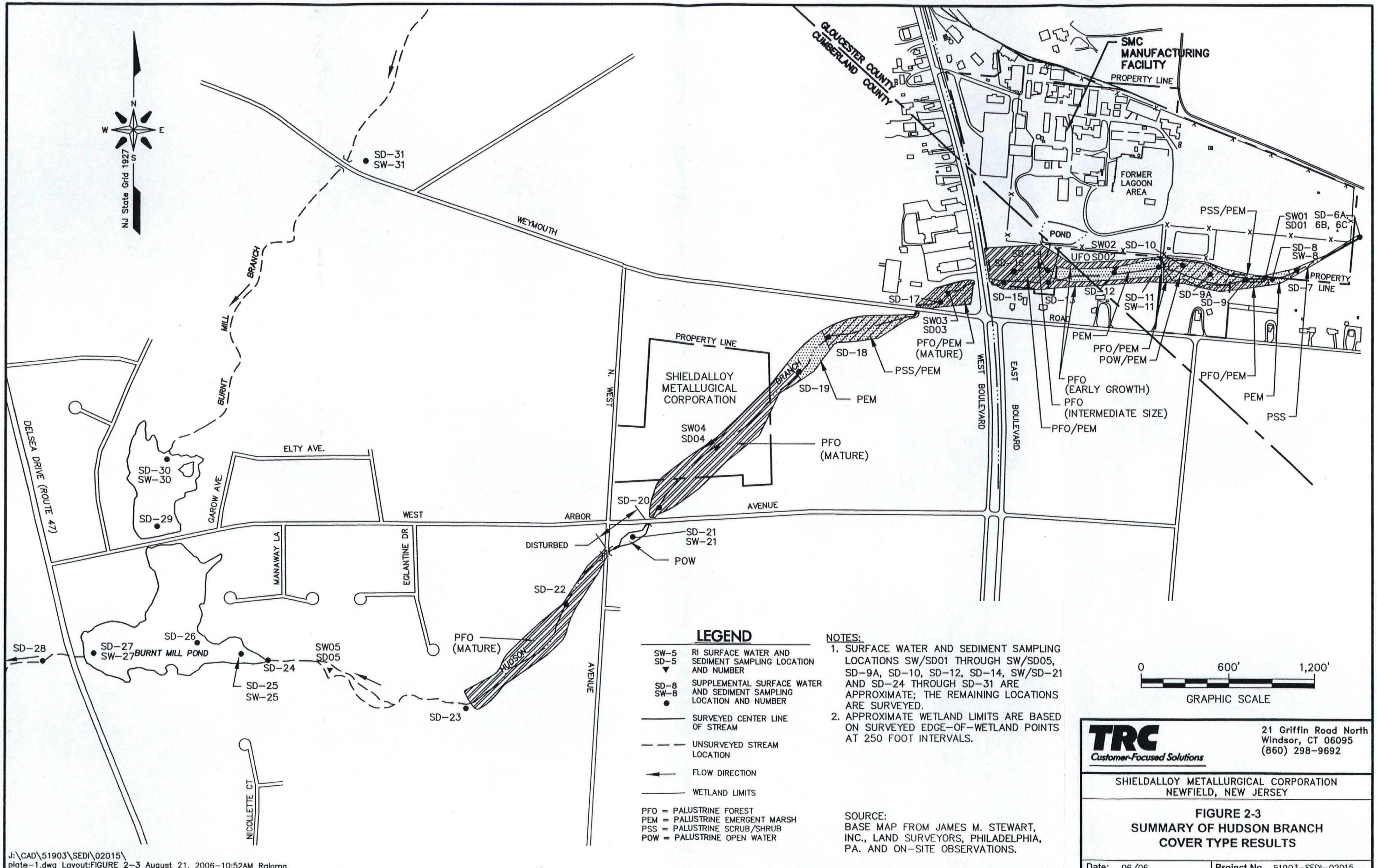

LEGEND

SW-5 SD-5 ▼	RI SURFACE WATER AND SEDIMENT SAMPLING LOCATION AND NUMBER
SD-8 SW-8 ●	SUPPLEMENTAL SURFACE WATER AND SEDIMENT SAMPLING LOCATION AND NUMBER
———	SURVEYED CENTER LINE OF STREAM
— — —	UNSURVEYED STREAM LOCATION
◄—	FLOW DIRECTION
———	WETLAND LIMITS

PFO = PALUSTRINE FOREST
PEM = PALUSTRINE EMERGENT MARSH
PSS = PALUSTRINE SCRUB/SHRUB
POW = PALUSTRINE OPEN WATER

NOTES:

1. SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS SW/SD01 THROUGH SW/SD05, SD-9A, SD-10, SD-12, SD-14, SW/SD-21 AND SD-24 THROUGH SD-31 ARE APPROXIMATE; THE REMAINING LOCATIONS ARE SURVEYED.
2. APPROXIMATE WETLAND LIMITS ARE BASED ON SURVEYED EDGE-OF-WETLAND POINTS AT 250 FOOT INTERVALS.

SOURCE:
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FIGURE 2-3
SUMMARY OF HUDSON BRANCH COVER TYPE RESULTS

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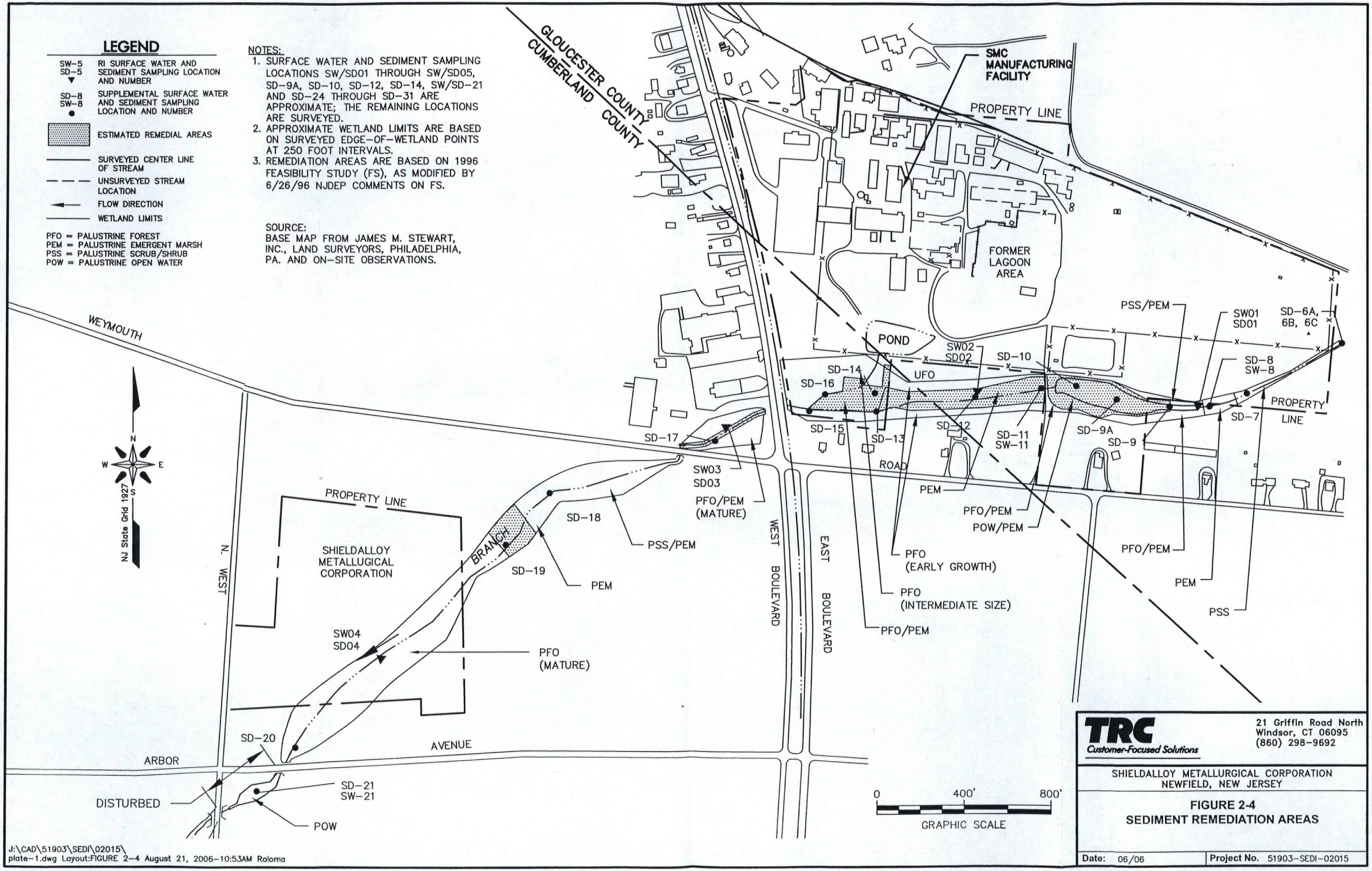
plate-1.dwg Layout:FIGURE 2-3 August 21, 2006-10:52AM Raloma



LEGEND

- SW-5 / SD-5 ▼ — RI SURFACE WATER AND SEDIMENT SAMPLING LOCATION AND NUMBER
- SD-8 / SW-8 ● — SUPPLEMENTAL SURFACE WATER AND SEDIMENT SAMPLING LOCATION AND NUMBER
- ESTIMATED REMEDIAL AREAS
- SURVEYED CENTER LINE OF STREAM
- UNSURVEYED STREAM LOCATION
- FLOW DIRECTION
- WETLAND LIMITS

PFO = PALUSTRINE FOREST
PEM = PALUSTRINE EMERGENT MARSH
PSS = PALUSTRINE SCRUB/SHRUB
POW = PALUSTRINE OPEN WATER

NOTES:
1. SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS SW/SD01 THROUGH SW/SD05, SD-9A, SD-10, SD-12, SD-14, SW/SD-21 AND SD-24 THROUGH SD-31 ARE APPROXIMATE; THE REMAINING LOCATIONS ARE SURVEYED.
2. APPROXIMATE WETLAND LIMITS ARE BASED ON SURVEYED EDGE-OF-WETLAND POINTS AT 250 FOOT INTERVALS.
3. REMEDIATION AREAS ARE BASED ON 1996 FEASIBILITY STUDY (FS), AS MODIFIED BY 6/26/96 NJDEP COMMENTS ON FS.

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

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FIGURE 2-4
SEDIMENT REMEDIATION AREAS

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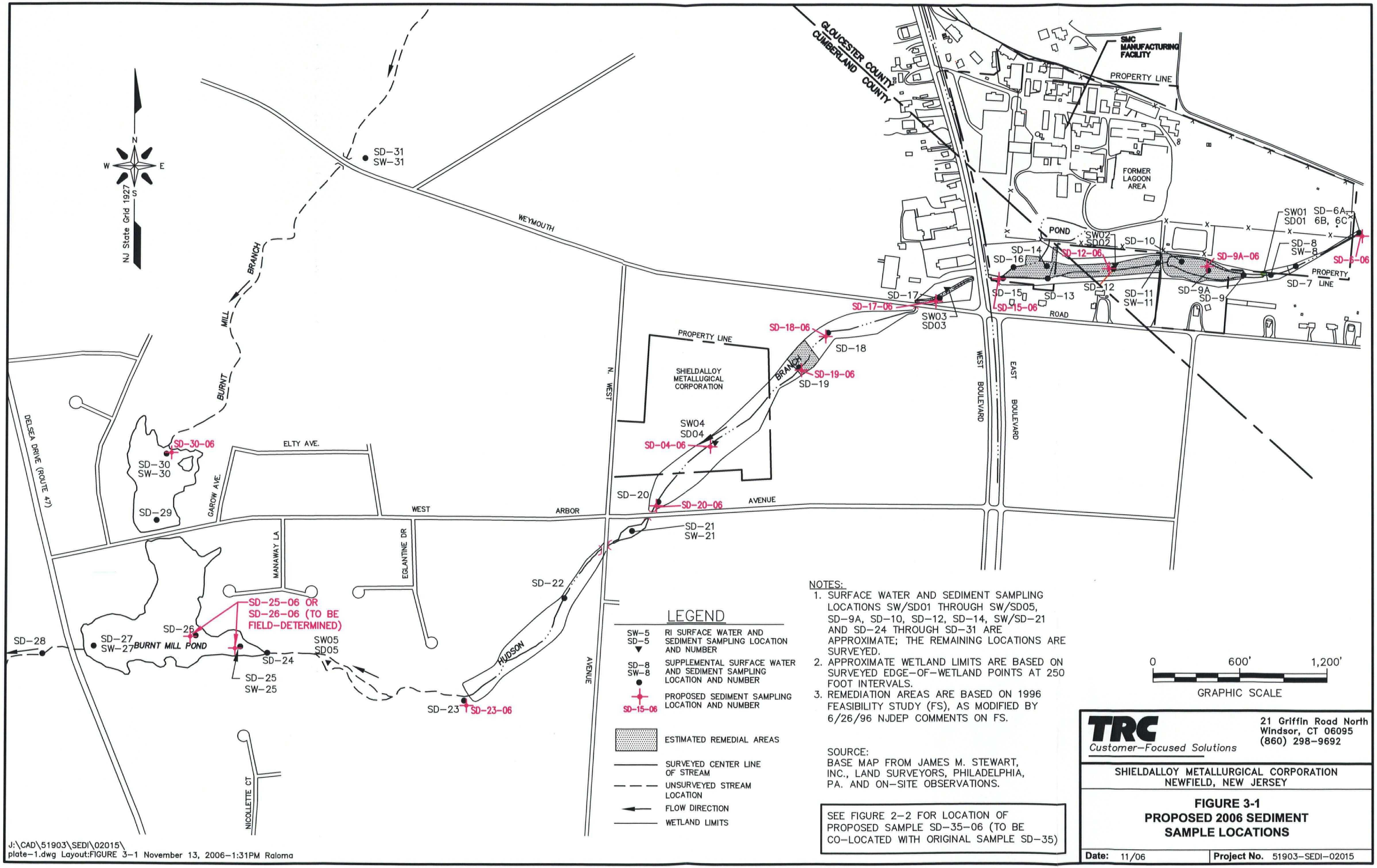
J:\CAD\51903\SEDI\02015\plate-1.dwg Layout:FIGURE 2-4 August 21, 2006-10:53AM Raloma



NOTES:

1. SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS SW/SD01 THROUGH SW/SD05, SD-9A, SD-10, SD-12, SD-14, SW/SD-21 AND SD-24 THROUGH SD-31 ARE APPROXIMATE; THE REMAINING LOCATIONS ARE SURVEYED.
2. APPROXIMATE WETLAND LIMITS ARE BASED ON SURVEYED EDGE-OF-WETLAND POINTS AT 250 FOOT INTERVALS.
3. REMEDIATION AREAS ARE BASED ON 1996 FEASIBILITY STUDY (FS), AS MODIFIED BY 6/26/96 NJDEP COMMENTS ON FS.

SOURCE:
BASE MAP FROM JAMES M. STEWART, INC., LAND SURVEYORS, PHILADELPHIA, PA. AND ON-SITE OBSERVATIONS.

SEE FIGURE 2-2 FOR LOCATION OF PROPOSED SAMPLE SD-35-06 (TO BE CO-LOCATED WITH ORIGINAL SAMPLE SD-35)

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FIGURE 3-1
PROPOSED 2006 SEDIMENT SAMPLE LOCATIONS

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plate-1.dwg Layout:FIGURE 3-1 November 13, 2006-1:31PM Raloma